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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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84 LAW AND POLITICAL SCIENCE N.A.
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 2881
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 2883
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS N.A.
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 2885
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 2885
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 2886
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL N.A.

Note: N.A. means that no abstracts were assigned to this category for this issue.

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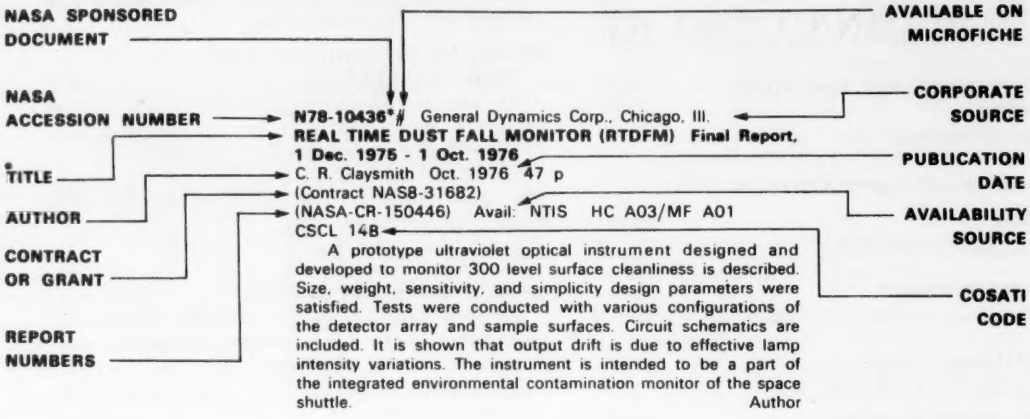
TYPICAL CITATION AND ABSTRACT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NASA ACCESSION NUMBER
N78-10436*# General Dynamics Corp., Chicago, Ill.
CORPORATE SOURCE
REAL TIME DUST FALL MONITOR (RTDFM) Final Report, 1 Dec. 1975 - 1 Oct. 1976
TITLE
PUBLICATION DATE
C. R. Claysmith Oct. 1976 47 p
AUTHOR
(Contract NAS8-31682)
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COSATI CODE
A prototype ultraviolet optical instrument designed and developed to monitor 300 level surface cleanliness is described. Size, weight, sensitivity, and simplicity design parameters were satisfied. Tests were conducted with various configurations of the detector array and sample surfaces. Circuit schematics are included. It is shown that output drift is due to effective lamp intensity variations. The instrument is intended to be a part of the integrated environmental contamination monitor of the space shuttle.
Author
REPORT NUMBERS

ON-GOING RESEARCH PROJECTS

This is a listing of research projects— not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, FLUIDIC SYSTEMS OR DEVICES FOR FUTURE NAVY V/STOL AIRCRAFT

UNKNOWN, Signal Companies Incorporated, *Phoenix, Arizona* 85034 (DN890039; N00019-78-C-0051)

Conduct a research and development program to define applications and requirements of fluidic systems or devices for future Navy V/STOL aircraft. Applications will be identified where advantages can be identified over more conventional approaches.

Define applications of fluidics systems or devices to future Navy V/STOL aircraft. This shall include suggested replacements for standard pneumatic or hydraulic equipment or unique concepts as applied to V/STOL. Define requirements of the fluidic hardware. Define advantages and disadvantages of implementing a fluidic approach to the hardware.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0002, 270 V DC AVIONIC POWER SUPPLY IMPACT STUDY

W. CLOUD, Lockheed Aircraft Corporation, *Burbank, California* 91503 (DN881390; N62269-77-C-0472)

To investigate the impact on avionic equipment power supplies when redesigned to perform from the 270 V DC power system versus the present AC 400 Hz power system. This contract supports work unit ZA601, Agency Accession No. DN681080.

To perform a detailed design analysis of the avionic equipment power supplies on the S3A aircraft to assess the impact of designing for performance from the 270 V DC power system.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0003, ADVANCED RESIDUAL STRENGTH DEGRADATION RATE PREDICTION METHODS FOR COMPOSITE STRUCTURES IN MILITARY AIRCRAFT

D.E. PETTIT, Lockheed Aircraft Corporation, *Burbank, California* 91503 (DF140290; F33615-77-C-3084)

Current Air Force structural integrity policy requires that all 'safety of flight' structures on new Air Force aircraft will be designed to be damage-tolerant, that is, it requires that the structure shall have a specified minimum residual strength (with damage present) at the end of a specified period of unrepaired service usage. Compliance with this policy requires the ability to predict failure modes and residual strength levels in the presence of probable types of manufacturing deficiencies and service-induced damage. The objective of this program is to develop an analytical methodology for prediction of residual strength degradation and damage growth caused by fatigue loading in advanced composite structural laminates. The results will be used to design more damage-tolerant and durable military aircraft structures.

An experimental program will be conducted to measure the residual strength of structural composite laminates as function of fatigue-induced damage growth and to document the damage growth process. The data will be used to develop an analytical methodology for predicting the residual strength. The effect of environment on residual strength and damage growth will also be assessed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0004, SUPERSONIC CRUISE/TRANSONIC MANEUVER WING SECTION DEVELOPMENT

C.D. WILER, Rockwell International Corp., *Los Angeles, California* 90009 (DF139870; F33615-77-C-3066)

Current advanced tactical aircraft missions include requirements for efficient supersonic cruise configurations capable of effective transonic maneuver. This effort is directed toward the application of advanced aerodynamic technologies in achieving such performance and represents a significant step toward the achievement of an improved force capability pending favorable results.

A wing design, which will include specification of thickness, camber, taper, and twist, will be evolved using analytical, design, and/or experimental techniques consistent with the current state of the art. Appropriate revolutionary configurations and approaches which represent advanced aerodynamic technologies will be incorporated into the design in order to overcome the aerodynamic configuration incompatabilities of the supersonic cruise and transonic maneuver flight regimes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0005, VERIFICATION OF A 3-D TURBULENT BOUNDARY LAYER CODE

J.F. NASH, Sybucon Incorporated, *Atlanta, Georgia* 30339 (DF140700; F33615-77-C-3116)

The effort is in the area of improving aerodynamic prediction capabilities. A newly developed boundary layer code applicable to compressible flow on finite, thick wings requires verification. The objective is to establish the generality and reliability of the code thereby promoting user confidence. The development of dependable aerodynamic prediction tools can lead to decreased costs in the design of new aircraft systems.

Detailed comparisons will be made between the Nash and Scruggs 3-D boundary layer code and recent experimental results for which both mean and fluctuating velocity measurements are available. Included in the comparisons will be sensitivity studies aimed at the selection of optimal set of empirical constants in the turbulence model used in the code.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0006, NAVY VEHICLE DESIGN AND CONSTRUCTION - GENERIC V/STOL AIRCRAFT STABILITY AND CONTROL INVESTIGATION

S. GULLY, Analytic Sciences Corporation, *Reading, Massachusetts* 01867 (DN875061; N00014-77-C-0775)

There is a continuing need to develop and apply new methods for analyzing the stability and design the control system of aircraft. This is especially true for Navy V/STOL aircraft especially in hover and transition to and from hover flight modes. The objective of this investigation is to apply advanced methods of analysis developed under previous ONR support to obtain a better understanding of generic V/STOL stability and control characteristics.

Using known characteristics of such V/STOL aircraft as the AV8A and AV8B, new analytical methods will be applied to predict the open loop stability boundaries of subsonic and supersonic V/STOL aircraft during hover, transition to and from hover, conventional maneuvering flight, direct lifting maneuvering flight (vectored thrust) and ground effects.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0007, AIRCRAFT PARAMETER IDENTIFICATION (HIGH-ALPHA AND V/STOL)

H. STALFORD, Dynamics Research Corporation, *Wilmington, Massachusetts* 01887 (DN881148; N62269-76-C-0342)

To develop an EBM (estimation before modeling) parameter identification method for high angle-of-attack flight and to demonstrate EBM method feasibility in a V/STOL aircraft application. This contract supports work unit ZA601, 'Aircraft Technology,' Agency Accession Number DN681080.

The NADC T-2 high-alpha flight test data and the VAK-191B flight data are being used to develop the EBM algorithms. Major emphasis is on the high-alpha work. Identification will be accompanied by in-depth comparison of results with special tunnel data.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0008, SALT WEATHERING OF PAVEMENTS

J. SAYWARD, U.S. Army, Cold Reg. Res. & Engin. Lab., *Hanover, New Hampshire* 03755 (DA0F8140)

Establish the mechanism whereby pavements undergo serious deterioration due to the use of de-icing chemicals in winter. A better understanding of this mechanism may lead to substantial reduction in the rehabilitation costs for pavements at northern military facilities and airfields.

Approximately 40 carefully prepared concrete samples will be tested in 10 different solutions under an array of air nozzles.

SUPPORTED BY U.S. Dept. of Defense, Office Chief of Engineers, Corps of Engineers

1.0009, GAS TURBINE ENGINE EXHAUST EMISSION GOALS FOR THE NAVY

A.F. KLARMAN, U.S. Navy, Air Propulsion Test Center, *Trenton, New Jersey* 08641 (DN796815)

Determine the accuracy and precision of a computer model in predicting ambient air quality by measuring the effects of aircraft operations on the ambient air quality at a Naval Air Station (NAS). Establish pollution emission goals for future Navy aircraft gas turbine engines based upon actual effect of current aircraft operations on air quality in the vicinity of NAS.

Monitor the ambient air quality in the local environs of a NAS. Predict the ambient air quality at a NAS based on the model, aircraft operational procedure employed, engine emission levels, and weather. Monitor the actual ambient air quality and compare the measured and predicted air quality levels. Determine the accuracy and precision of the model. Review the model and make modifications if necessary. Perform sensitivity analysis on the model to determine the effects of various weather conditions, and changes in operational procedures and aircraft inventory at the NAS. With the model, weather conditions and operational procedures, and aircraft inventory of other NAS's, predict the effect of their operations on ambient air quality.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Material Command

1.0010, FABRICATION OF F-14 COMPOSITE OVERWING FAIRINGS FOR SERVICE EVALUATION

J. MAHAN, Grumman Corporation, *Bethpage, New York* 11714 (DN681283; N62269-75-C-0449)

To demonstrate the service durability and structural reliability of advanced fiber-reinforced composite aircraft structures under actual Navy operational usage. To determine the reproducibility of such structures when produced by a pilot production program and to provide realistic manufacturing cost data which can be used as a basis for future economic projections. This work is in support of WU ZA101, Aircraft Technology, Agency Accession No. DN 681080.

A limited-production quantity (5 ship-sets) of F-14 composite overwing fairings will be manufactured using pilot production practice and techniques. These composite fairings were originally designed and developed under NavAir contract N00019-73-A-0070, and tested at the NavAirDevCen. The manufacturing methods used will simulate large-scale production techniques; the quality of the fairings so produced will be assessed, manufacturing costs will be closely monitored, and learning-curve predictions will be verified. The composite fairings will be installed on F-14 aircraft in fleet service, and subjected to a variety of service usage and operating environments; their condition will be periodically monitored during the life of the aircraft. (The present contract covers only the manufacture of the fairings, not their service evaluation.)

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0011, FLOTATION FOR AIRCRAFT, TECHNOLOGY (FLOAT) INVESTIGATION

J. RIGSBEE, Grumman Corporation, *Bethpage, New York* 11714 (DN881118; N62269-77-R-0277)

The general objective is to provide an automatic flotation system for Navy aircraft. Such system will be carried on-board during peacetime operations and shall prevent an aircraft and its attached missiles from sinking to the bottom of the ocean following ditching or inadvertent loss from ship decks. The specific objective of this task is to determine optimum location, mechanization techniques and operational implications for such system. The advantage to the Navy would be rapid, low-cost recovery of politically sensitive aircraft and warheads. A secondary advantage may be realized by reconditioning recovered high-cost airframe and equipment components of new aircraft. This contract supports work unit DH819.

The F-14 aircraft has been selected as the investigation base line because of its planned long service use. After a final, recommended flotation configuration has been defined, a kit type demonstration system shall be developed, verified in the laboratory for adequacy and tested for flotation capability with a surplus airframe. This concept shall be directed toward minimum aircraft modification, weight and effect on primary mission capability. The concept will be aimed at usage on several aircraft types.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0012, ADVANCED ELECTRONIC FLIGHT CONTROL SYSTEM DEVELOPMENT (INTEGRATED SENSORY SUBSYSTEM)

W.D. WEINSTEIN, Grumman Corporation, *Bethpage, New York* 11714 (DN781227; N62269-76-C-0235)

To develop a fail-operational, combat-survivable, and highly reliable angular rate sensor system for future Navy aircraft. This contract supports work unit ZA601, Agency Accession No. DN681080.

Design and fabricate flight-test hardware, and verify the performance of the ASSET IIIA (Advanced Skewed Sensory Electronic Triad) system in preparation for flight testing in an A-6A aircraft.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0013, AIRCRAFT VIBRATION MODULATION
J.F. LENNON, U.S. Air Force, Rome Air Development Ctr., *Rome, New York* 13440 (DF902850)

The objective of the research is to examine the interaction between radar signals and targets which are undergoing cyclic airframe motions representative of those expected to be present under actual mission situations. This effort is intended to address topics in the area of advanced radar detection and identification of aircraft. Deficiency -the problem which this program addresses is the need for enhanced techniques for noncooperative identification of tactical aircraft through their radar signatures under operational conditions. The study of simulated airframe motions and radar signals oyer ranges of aspect angle, structural motion, and aircraft configuration will present some theoretical basis for exploring further possibilities of aircraft identification under tactical flight conditions.

The research under this effort involves theoretical simulation of the interaction of radar signals with structures that show periodic changes representative of aeroelastic airframe motion. Initial efforts involve investigating the use of crossed wires in three-dimensional configurations to simulate aircraft with wing flutter characteristics. The phase changes in the scattered signal as the wire orientation is altered will be examined over ranges of aspect angle, periodicity, and model configuration. Data on actual airframe frequency patterns which is being examined under contract may be eventually included to enhance the simulation. The work can also be extended to include rigid body motions such as yaw or roll, or even vehicle coning associated with automatic control operation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

1.0014, PREFERENCED-ORDERED DISCRETE-GAMING AIR-TO-AIR COMBAT MODEL
H.J. KELLEY, Analytical Mech. Assoc. Inc., *Westbury, New York* 11590 (DF141030; F33615-77-C-3144)

Military operations of fighter weapon systems impose significant technical problems from both a design and tactical standpoint. New systems are designed under the philosophy that they will control the combat arena. This levies requirements on performance from both an offensive and defensive standpoint. The objective of this effort is to develop a method for evaluating fighter weapon systems engaged in air-to-air combat for different fighter roles.

This is an analytical performance analysis of a preference-ordered discrete-gaming air-to-air combat model. A fighter's primary role is the ability to kill another fighter and the last or most undesirable role is the likelihood that he will be killed. In between are other roles that occur in combat. The first phase of this effort will consist of extending current capabilities to variable speed systems. The second phase will consist of the validation of the model and application of future weapon systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0015, REGRESSION SIMULATION TURBINE PERFORMANCE (GE)
D. UEHLING, General Electric Company, *Cincinnati, Ohio* 45215 (DF462350; F33615-77-C-2108)

The objective of this program is reduce the cost of using the procedures developed under the TEVCS/ARES programs (Contracts F33615-73-C-2070 and F33615-73-C-2084, respectively) while maintaining or improving the accuracy levels necessary for a meaningful propulsion concept evaluation and/or cycle selection.

Based on the above objective, four major tasks have been identified for investigation and evaluation. Task I deals directly with reducing propulsion data generation costs by reducing parametric deck size and by improving computer execution time per data point. Task II reduces the amount of propulsion data required to assess a given engine design. Task III provides the data base necessary to permit the propulsion manufacturer to establish in-house the important preliminary propulsion characteristics based on a realistic airframe data base. This should allow the propulsion manufacturer to tailor general propulsion concepts to a specific application and to identify meaningful propulsion variables which are well suited for use in the TEVCS/ARES methodologies. Task IV is concerned with improving the accuracy of the present TEVCS/ARES regression procedures to improve concept evaluation and cycle selection capability and to accommodate possible inaccuracies due to the propulsion data cost reductions developed in Task I.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0016, DEVELOP NEW TECHNOLOGY CONCEPTS FOR AERODYNAMIC GROUND TESTING
D.M. PAROBEK, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF141810)

In the development of advanced tactical and V/STOL fighters, transonic transports, experimental hypersonic cruise aircraft, as well as other hypersonic strategic weapons systems, subsonic and transonic aerodynamic characteristics are particularly problematic and must be studied extensively in a quality test flow. The Aeromechanics Division has no such in-house facility to carry out this mission because of conversion to space-oriented facilities in the early 1960's. The objective of this effort is to develop new concepts for aerodynamic ground testing up through the transonic regime and also the hypersonic regime, to more effectively impact development of current and future weapons systems.

Analytical and prototype experimental studies will be performed for an advanced transonic test section design for a new gas-dynamic facility. Advanced capabilities and test concepts for high-energy flow test facilities will be studied.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0017, ADVANCED CARGO RESTRAINT SYSTEM INVESTIGATION FOR COD AIRCRAFT
J. SHEFRIN, Boeing Company, *Philadelphia, Pennsylvania* 19142 (DN881349; N62269-77-C-0342)

This investigation is intended to produce a concept specification for an advanced cargo restraint system. The primary objectives of such an advanced system shall be reduction in restraint equipment weight; reduction in time required for cargo handling, tiedown and release; minimum stowage volume; and low cost. Energy management techniques shall also be applied to the cargo restraint system to enhance survivability of passengers and crew under crash conditions. The selected system shall be acceptable to current Navy COD (Carrier Onboard Delivery) as well as future V/STOL aircraft with COD or VOD (Vertical Onboard Delivery) capabilities.

This effort requires correlation of COD aircraft (C2A) operational requirements, cargo configurations, aircraft tiedown geometry, energy management concepts, tension device materials technology, aircraft crash dynamics, and existing Navy static crash load criteria. Trade-off investigations will be conducted leading to a recommended restraint system concept specification.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0018, V/STOL AIRCRAFT TAKEOFF PERFORMANCE ANALYSIS
J.D. CYRUS, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN781478)

Technical objective - to develop a computer code which shall be capable of analyzing the takeoff performance of V/STOL aircraft. The code shall be developed with the capability of optimizing takeoff performance by maximizing aircraft gross weight or by minimizing takeoff distance. The code shall consider thrust and drag variations due to changes in velocity, aircraft attitude, and thrust vector angle. Time-dependent changes in nozzle position and location-dependent changes in aircraft attitude shall also be considered.

Approach - existing takeoff programs available in the industry shall be reviewed for their suitability. If no code completely meets the Navy's requirements, a new or modified code shall be

developed. An integration technique shall be used to provide aircraft attitude, nozzle position for both forward and aft engines, velocity, thrust and drag information as a function of both time and distance during the takeoff run. Tabular inputs for thrust and drag data shall be included with emphasis being placed on providing flexibility for the independent variables. Drag, for example, may be input as a function of both aircraft velocity and nozzle rotation angle.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0019, DISTRIBUTED STORE LOADS PREDICTION
W.B. BAKER, Arnold Research Org. Inc., *Tullahoma, Tennessee* 37389 (DF421057; F40600-77-C-0003)

To develop techniques to both analytically predict and experimentally measure distributed aerodynamic loads on a store in an interference flow field.

Gross and distributed loads calculations from modified CAMS 045 program will be compared with experimental data. Feasibility of modifying the program to calculate distributed loads in an interference flow field will be investigated. Neilsen store separation program will be considered for possible use in making distributed loads calculations. Design criteria and test requirements will be established for a segmented model to measure distributed loads.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Arnold Engineering & Development Center

1.0020, DESIGN CONCEPTS FOR LATERAL ROLL-OVER PROTECTION
R.G. FOX, Bell Helicopter Company, *Fort Worth, Texas* 76101 (DA0E3795; DAAJ02-77-C-0078)

To develop concepts which will provide protection to occupants for Army aircraft involved in roll-over accidents.

Failure modes of cockpit and cabin areas of aircraft involved in roll-over accidents will be investigated and concepts will be developed to strengthen side and upper fuselage members and to incorporate lateral energy-absorbing techniques into the structure.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0021, HT ST 78-33 - DESIGN AND STRUCTURAL EVALUATION OF AIRFRAME STRUCTURES (ARMY AIRCRAFT)
D. GOOD, U.S. Army, Applied Technology Laboratory, *Newport News, Virginia* 23604 (DA0E3818)

Task I - to develop advanced composite airframe structural design concepts/configurations to support future Army aircraft. The structural concepts and configurations developed will provide improved weight, structural integrity, and producibility characteristics over an all-metallic structure. Task II - to determine the applicability of 'tetra-core' as a structural configuration for Army helicopters structures (tailboom).

Task I - select a base line aircraft and establish a detail description of the base line metal cabin structure. Establish design criteria for composite materials applications. Develop preliminary design concepts/configurations for composite cabin structures and conduct a trade-off analysis considering structural integrity, weight, material applications, and producibility to determine the more promising advanced composite structures. Task II - develop/establish the analytical and fabrication capability for application of tetra-core to the AH-1G helicopter tailboom. Establish design criteria, cost, weight and 23mm ballistic damage tolerance characteristics.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0022, HT PP 76-12 - INVESTIGATION OF LIFE PREDICTION TECHNOLOGY FOR SMALL TURBINE ENGINES
UNKNOWN, U.S. Army, Applied Technology Laboratory, *Newport News, Virginia* 23604 (DA0E3833)

To investigate current techniques for determining expected life of small turbine engine component and to identify existing voids in technology which, if filled, could provide the Army and industry with more reliable and effective life-prediction tools. This investigation could result in further work to pursue improved life prediction techniques and allow better component design capability for particular mission requirements, longer mean-time-between-overhauls with equivalent flight safety, and reduction of total engine hardware required.

Utilizing information from the literature, government and industry, this program will investigate various stress analysis theories (2-D, 3-D) and metal temperature calculation techniques from the standpoint of usability, effectiveness and accessibility of computer codes, stress concentration factors and coating effects, etc., and identify potential improvements which could advance life prediction technology. The output of this program will include the current status of life prediction relative to Army needs for future work, where feasible, to fill the voids in technology.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, NAVY VEHICLE DESIGN AND CONSTRUCTION - HIGH-STRENGTH HIGH-STIFFNESS PARTICULATE COMPOSITE MATERIALS
O.D. SHERBY, Stanford University, School of Engineering, *Palo Alto, California* 94305 (DN723740; N00014-75-C-0662)

This research is aimed at composite materials with improved strength-to-stiffness for use in jet engines and airframes. Under investigation are the effects of processing variables on the structure and mechanical properties of particulate composites.

Particulate composites of steel powders will be prepared and tested. Variables will include volume percent of the high-carbon steel and low-carbon steel powders, carbon content and size of the particles, and heat treatment parameters. Composites of a magnesium alloy containing boron in varying amounts will be prepared and tensile properties measured over the temperature range of 25 to 400 degrees centrigrade.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0002, CORRELATION OF DEFORMATION MECHANISMS AND SOURCES OF ACOUSTIC EMISSION OPERATIVE DURING DEFORMATION OF CRYSTALLINE MATERIALS
S.H. CARPENTER, Univ. of Denver, School of Engineering, *Denver, Colorado* 80210 (DMR77-23782)

This is a continuation of an investigation to identify sources of acoustic emission operative during mechanical deformation of metallic materials. In addition to acoustic emission data, the mechanical damping and modulus defect are independently and simultaneously measured. The data obtained are used to establish correlations between particular emission characteristics and particular sources and deformation mechanisms for well-characterized metallic materials. This is a renewal of NSF Grant DMR73-02382 A01. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

3.0003, NAVY VEHICLE DESIGN AND CONSTRUCTION - FIBER-REINFORCED METAL MATRIX COMPOSITES
K.M. PREWO, United Technologies Corp., *Hartford, Connecticut* 06108 (DN675085; N00014-76-C-0035)

Composite materials are seeing increased use in aircraft and other highaperformance vehicles due to their high specific strength and stiffness. New alumina and silicon carbide fibers suggest that these high-strength materials might be suitable as reinforcements for metal matrices. The investigator will examine their suitability in this application.

Several types of continuous alumina fibers will be characterized in terms of their properties and structure. Liquid metal infiltration will be used to form alumina/aluminum composites. Variables in the infiltration process will be examined as part of this effort. Infiltrated composites will be evaluated to determine their structure-property relationships. Fibers will be extracted to measure any degradation in properties as a result of the infiltration step. Mechanical testing of alumina/aluminum composites made under the best conditions will be initiated following these other analyses.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0004, FRACTURE MECHANICS RESEARCH INVOLVING MINORITY STUDENTS

D.L. JONES, George Washington Univ., School of Engin. & Appl. Sci., *Washington, District of Columbia* 20037 (DN790019; N00019-77-C-0160)

Program to obtain an improved understanding of the effects of cyclic loading on the fracture toughness and strength of aircraft structural materials.

Study the relationship between the cyclic load-displacement record and the number of load cycles for several materials, including 7050 Al and Ti6Al-4V GFC will examined at higher cyclic parameters.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0005, NAVAL VEHICLE TECHNOLOGY - MOLECULAR ASPECTS OF POLYMER AND ADHESIVE FAILURE

W.D. BASCOM, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN620102)

To improve the strength and performance of structural adhesives and fiber-reinforced composite materials by improving the mechanical properties of polymers and their adhesion to metals and reinforcing fibers. This research is of importance in improving the strength of the composites and adhesives used in naval aircraft and ship construction.

The relationships of chemical composition and structure to the failure micromechanics of polymers stress are being determined experimentally. The investigational techniques include thermorheological and thermomechanical analyses, fracture testing and microscopy.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

3.0006, IMPROVED POWDERS FOR CERAMIC PROCESSING

P.F. BECHER, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN680080)

To produce improved ceramic powders having fine particle size and with minimal contents of both cation and anion impurities. A secondary objective is to achieve improved mixing of multiconstituent powders.

To prepare powders by vaporization of the appropriate metal or metals and reaction of that vapor with the appropriate gas, i.e., oxygen for oxides, nitrogen for nitrides, methane for carbides, and borane for borides. Mixing will be accomplished by simultaneous reaction, or by aerosol mixing, possibly using particle charging. Powders will be collected and processed in a controlled environment, avoiding contamination, to determine the degree of improvement that results in bodies fabricated from such powders.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0007, WEAR-RESISTANT COATINGS FOR TITANIUM ALLOYS

B.A. MANTY, United Technologies Corp., *West Palm Beach, Florida* 33402 (DN790049; N00019-77-C-0330)

To develop wear-resistant coatings for titanium alloys in dynamically loaded structural and functional applications in naval aircraft.

Develop and optimize chromium-molybdenum coating (1) composition, (2) pre- and post-deposition treatments, (3) deposition processes and (4) effects on substrate physical and mechanical properties.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0008, WEAPONRY - SYNTHESIS AND CHARACTERIZATION OF NEW COMPLEX LIGHT METAL HYDRIDES

E.C. ASHBY, Georgia Inst. of Technology, School of Chemistry, *Atlanta, Georgia* 30332 (DN823133; N00014-75-C-0307)

New or improved chemical rocket propellants are needed for the propulsion systems of Navy vehicles for tactical and surveillance missions in the atmosphere and nearby space. This task, in seeking new hydrides as candidate ingredients for solid propellants, may contribute significantly to the fuel portions of rocket propellants at higher energy levels.

Study the stability of diethyl ether soluble aluminum hydride, discovered under this contract, and its use in the synthesis of other simple and complex metal hydrides. Continue the preparation and characterization of complex metal hydrides of copper and initiate studies on new complex hydrides of beryllium.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0009, EFFECT OF APPLIED STRESS, THERMAL ENVIRONMENT AND WATER IN EPOXY RESINS

L. NICOLAIS, Univ. of Naples, *Naples, Italy* 80100 (DF049200; AF-AFOSR-3369-77)

AF function - advanced aerospace vehicles will achieve higher performance through the use of advanced composite primary structure. Deficiency - there is no acceptable fatigue life prediction method for composites which considers moisture and elevated temperature behavior. Objective - objective of this research is to establish a quantitative description of moisture transport in polymer matrix materials considering environmental conditions, thermal histories and applied stress states. How work contributes - results of this research will contribute to the development of a rational fatigue life prediction methodology.

This research will characterize the mechanical performance and transport behavior of epoxy resins due to elevated temperature and moisture environments. Measurement techniques will be extended to determine the moisture concentration gradient in a polymer. Permeability, diffusion and distribution coefficient will be determined as a function of lamina thickness and temperature. The presence of compressive forces should reduce the rate and maximum value of water absorption and reduce swelling and will be measured. Effect of a sudden increase in temperature on a swollen material can induce the instantaneous formation of microcavities and cracks. Thermal cyclic experiments will be conducted to study this phenomena.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0010, DEFECT AGGREGATION IN IRRADIATED MATERIALS

K.C. RUSSELL, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (DMR77-23402)

This is a continuation of basic studies on phase stability and void formation in irradiated metallic materials. The theoretical work will employ the nodal line/critical point formalism of Poincare. A recently developed theory for phase stability under irradiation conditions will be generalized to include the effects of displacement cascade-induced dissolution and solute drag. A combined theoretical/experimental program on irradiation al-

tered precipitation in Al-Ge and Al-Si will be continued. Numerical evaluation of the rate equations for precipitate nucleation under irradiation will be done at M.I.T., the experimental work at Harwell, England. A theory for homogeneous void nucleation is to be extended to heterogeneous nucleation at interphase boundaries and dislocations. Nucleation kinetics will be analyzed in terms of helium and vacancy trapping and defect energetics; expressions for the nucleation rate and terminal void number density will be derived. This is a renewal of NSF Grant DMR73-07609 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

3.0011, ENERGY TRANSPORT IN MOLECULAR SOLIDS

R. KOPELMAN, Univ. of Michigan, School of Lit. Sci. & The Arts, *Ann Arbor, Michigan* 48104 (DMR77-00028 A01)

Exciton energy transport in disordered molecular aggregates is being investigated theoretically and experimentally. The theoretical formalism involves percolation, i.e., motion through a randomly disordered medium. Long-range exciton motion in such a molecular solid requires a connected cluster of molecules having an energy band that is accessible to the given exciton. This band is usually lower in energy than all the bands of the 'inaccessible' molecules. Characteristic of percolation phenomena is a drastic change in percolation (i.e., exciton mobility) at a critical value of an order parameter (i.e., concentration of accessible molecule), analogous to the critical behavior of the magnetization at a Curie point.

The theoretical study involves a refinement of the percolation criteria, with emphasis on the distinct results obtained for excitons with short-range interactions (i.e., electron exchange) and long-range ones (i.e., dipole-dipole). The distinction between coherent exciton motion and diffusion-type motion will also be investigated for randomly disordered lattices.

Experimentally, exciton transfer is being examined in chemically and isotopically mixed crystals under steady state and pulsed, wide-band and very narrow-band photon excitation. The aim is to study the time development of exciton transport, trapping and fusion, for a range of 'order parameters' (i.e., concentration, electric field, photon and phonon flux). Research supported under DMR75-07832 A01; first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

3.0012, THE STRUCTURE OF DISPERSED LYOTROPIC LIQUID CRYSTALLINE PHASES

S. FRIBERG, Univ. of Missouri, School of Arts & Sciences, *Rolla, Missouri* 65401 (DMR76-23569 A01)

Lyotropic liquid crystals have been shown to have a pronounced influence on the stability of disperse systems such as emulsions and foams. The first report on this effect was published less than ten years ago, but the phenomenon has already been applied in technical developments within different areas, such as the pharmaceutical and food technology industries and for the dispersion of essential components in a variety of commodities, such as those used in the production of concrete and the application of paper coatings.

The objective of the program is a basic understanding of those factors that determine the adherence of a dispersed liquid crystal to an interface. The determinations include: (1) size distribution by optical and electron microscopy, viscosity, and light scattering; (2) the electric surface potential of dispersed, liquid crystalline particles by zeta-potential measurements; (3) comparison between the microscopic structure of the liquid crystal in bulk and in a dispersed state by low-angle X-ray diffraction and electron microscopy; and (4) interfacial tension measurements using the sessile drop method. Results from 3 and 4 are used to evaluate the influence of the anisotropic conditions at an interface on the geometric dimensions of the liquid crystalline structure. The evaluation is made from calculations of the Van der Waals pressure by using methods developed by Parsegian and collaborators. The results of these investigations will form the basis for establishing rules for the adherence of liquid crystals to interfaces. The application of these rules to technical problems within different industrial activities will take place in collaboration with the engineering departments and with industry.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

3.0013, A STUDY OF THE DYNAMICS OF FORMATION AND STRUCTURAL ANALYSES OF EXCITED STATES OF MOLECULAR IONS

A.J. YENCHA, State University of New York, School of Arts & Sciences, *Albany, New York* 12222 (INT77-15419)

This award will support Prof. A.J. Yencha (State University of New York at Albany) for six months collaborative research with Prof. K. Kuchitsu, University of Tokyo, under the auspices of the U.S.-Japan Cooperative Science Program. They will study the excited states of polyatomic molecular ions with respect to the method of production, their energies, electronic structures, geometries, and radiative, nonradiative and dissociative properties. Through a combination of photon impact, electron impact, metastable atom impact, and metastable ion impact, the dissociation, ionization, light- and electron-emission processes of polyatomic molecules will be investigated through optical, mass, and electron spectroscopy methods. The ultimate goal of this research is a fundamental understanding of the dynamics of molecular ion formation. The excited states of molecular ions are involved in the chemistry and physics of plasmas, flames, and planetary atmospheres of the earth, comets, and stellar and interstellar media. They are also important in the fields of radiation chemistry and mass spectrometry.

SUPPORTED BY U.S. National Science Foundation, Div. of International Programs

3.0014, NAVY VEHICLE DESIGN AND CONSTRUCTION - FLOW AND FATIGUE FRACTURE OF TITANIUM ALLOYS

H. MARGOLIN, Polytechnic Inst. of New York, School of Science & Engin., *Brooklyn, New York* 11201 (DN575245; N00014-75-C-0793)

This research effort will explore the flow and fatigue fracture behavior of alpha-beta titanium alloys. It will develop needed understanding of microstructural effects in this important class of alloys used in naval structures and jet engines.

The yield and flow behavior of alpha-beta titanium will be examined in a series of Ti-Mn alloys with Mn adjusted to provide 1 to 100 percent beta. Alpha morphology and distribution will be varied and the associated effects on flow behavior noted. Low-cycle fatigue behavior of Ti 6-2-4-6 will be investigated for two strength levels at different sizes of equiaxial alpha and Widmanstatten alpha. Initiation, crack growth and crack path will be determined. Void formation in Ti 6-4 will be correlated to the structure.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0015, THEORETICAL STUDIES OF CHEMISORPTION ON TRANSITION METAL SURFACES (INTERACTION OF HYDROGEN WITH TITANIUM)

J.L. WHITTEN, State University of New York, School of Arts & Sciences, *Stony Brook, New York* 11790 (9863-AC5)

The proposed research is concerned with the theory of chemisorption of molecules on solid surfaces, and is directed toward the development of a theoretical model for treating electronic interactions at an ab initio level. Calculations on the hydrogen-titanium system are proposed in which the objective is to obtain a detailed account of molecule-surface interactions, including an adequate response of the lattice to the incoming adsorbate and the likelihood that the adsorption of H2 on Ti (solid) is dissociative. In addition to treating a close-packed surface layer of Ti atoms, the introduction of a monoatomic step is also considered. The computational formulation is based on two main ideas: (1) the application of a recently developed approximation technique, utilizing error bounds on electrostatic interactions, which leads to a major organizational simplification of the problem, and (2) the definition of a local (surface) region, involv-

ing the adsorbate and a relatively small cluster of atoms, embedded in a fixed field of a larger cluster of atoms. The partitioning into regions is accomplished by an orbital localization scheme which incorporates directly into the definition of the local region essential characteristics of the initially delocalized description of the lattice (cluster).

SUPPORTED BY American Chemical Society

3.0016, ANALYSIS OF LUBRICANT FILMS IN BEARINGS UNDER INCIPIENT FAILURE CONDITIONS
J.L. LAUER, Rensselaer Polytechnic Inst., Graduate School, *Troy, New York* 12181 (DF051060; AF-AFOSR-3473-78)

AF function - propulsion systems for advanced aerospace vehicles require improved lubricants which will withstand a wider range of temperature conditions, greater contact loads and higher shear rates. Deficiency - lubricants continue to fail at elevated temperatures due to complex chemical and physical interactions of the bulk lubricant with its environment and with both static and moving metal surfaces. Objective - understand the bulk and boundary layer chemical-physical properties of lubricants to determine causes of bearing failure. How work contributes - information gained from this research will be used to formulate improved lubricants for AF application that can withstand conditions of extremely high temperatures, pressures and shear rates.

Infrared emission spectra will be obtained through a window in an operating sliding bearing lubricated by a number of standard fluids. A variety of realistic operating conditions will be probed. The spectra will be analyzed for chemical and physical changes in the fluids (e.g., decompositions, glass transitions), fluid film and metal surface temperatures, and molecular alignment by polarization techniques. Conditions leading to bearing failure will be probed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0017, EVALUATION OF EQUIVALENT
D. BROEK, Battelle Memorial Institute, *Columbus, Ohio* 43201 (DN881378; N62269-77-C-0543)

Determine the effect of metallurgical inclusions and clusters of inclusions on aircraft structural integrity and damage tolerance. This work is in support of work unit ZA601, Aircraft Technology, Agency Accession No DN681080.

A micro optical inclusion counting procedure will experimentally estimate the statistical distributions of inclusion size and cluster size versus frequency of occurrence for one standard aircraft structural material. The probabilities of encountering large inclusions and clusters, which may be detrimental to aircraft structural integrity, will be determined from these distributions. Based on these probabilities and practical considerations, an experimental test program will be formulated to establish the correlation between inclusions and equivalent initial flaws.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

3.0018, LITHIUM-BASED ANODES FOR SOLID-STATE BATTERIES
B.C. STEELE, Univ. of London, *London, England, United Kingdom* (DF050190; AF-AFOSR-3460-77)

AF function - a variety of communications and flight operations depend on auxiliary battery sources for power. Deficiency - lightweight, longer-life, high-energy density batteries are required to meet operational needs. Objective - this research involves determination of thermodynamic and transport properties of materials that could function as solid-state electrolytes and anodes. How work contributes -research results should permit new superionic materials to be developed and permit understanding of ion transport mechanisms. Materials may be of use in practical battery systems employing solid electrolytes.

Transport properties and thermodynamics of selected intermetallic compounds that could operate as lithium solid solution anodes would be studied. Thin solid-state electrolyte films of lithium nitrides and lithium oxy nitride would be prepared by several methods and properties compared. Interface processes between lithium-containing anode and solid electrolytes will be examined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0019, INVESTIGATION OF REINFORCED THERMOPLASTIC COMPOSITES
J.T. HOGGATT, Boeing Company, *Seattle, Washington* 98108 (DN890066; N00019-77-C-0561)

To evaluate fiber-reinforced thermoplastics for aircraft structural applications.

Develop methods for the impregnation and fabrication of improved thermoplastic materials to overcome deficiencies in solvent resistance and thermal stability. Investigate metal-clad thermoplastics for suitability as construction materials.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0020, MATERIAL SUPPORT TECHNOLOGY - ELECTRON SPECTROSCOPY OF SEMICONDUCTOR HETEROJUNCTION INTERFACES
M.G. LAGALLY, Univ. of Wisconsin, School of Engineering, *Madison, Wisconsin* 53706 (DN775535; N00014-77-C-0474)

The operational properties of solid-state electron devices used in Navy electronic systems, are often dominated by the electronic effects occuring at various solid surfaces and solid-solid interfaces. Understanding and controlling the surface effects are essential to improving performance and reliability.

Using surface analysis techniques such as Auger spectroscopy, ultraviolet photoemission spectroscopy, x-ray photoemission spectroscopy, and energy loss spectroscopy, the investigator will probe the local electronic properties of surface atoms. These atoms may represent the host material, adsorbed impurities, or atoms of an adjacent host material such as occurs in the semiconductor-semiconductor heterojunction. Determination of the local density of states at each atom will permit evaluation of the effects of impurities or surface states on the overall electronic nature of the surface. Of particular interest is the nature of the energy discontinuity which appears at the heterojunction interface. The local density of states will elucidate the nature of the discontinuity, and the auger spectroscopy may be the best method for obtaining this information. Initially gallium arsenide and gallium aluminum arsenide will be studied. Eventually other III-V and II-VI command semiconductors will be included.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, PROPULSION SYSTEM COST REDUCTION
W.S. CROWNOVER, U.S. Army, Technology Laboratory, *Huntsville, Alabama* 35809 (DA0F1409)

Demonstrate a low-cost propulsion technology package applicable to free-flight rocket motors and other high-production system motors.

This effort will exploit promising concepts and analytical techniques for reducing rocket motor costs. Areas of consideration will include adaptation of tubular products (metal and composite) low-cost nozzle/closure forming and joining methodology and a braided fiberglass integral case/nozzle concept demonstration. Demonstration motor firings will be conducted for selected concepts to generate performance parameters. Participation will continue in the tri-service program to develop a body of information that relates propulsion system requirements to propulsion life-cycle tests. Also included will be an effort on service life prediction which will combine development and verification of realistic thermal loads with improvement to the methods for assessing propellant grain crack formation and propagation. The effect of field and operational environments on rocket motors will provide engineering data to support propulsion design activities.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Propulsion Directorate

4.0002, STUDIES OF OPTICAL-BEAM PHASE-CONJUGATION BY NONLINEAR REFRACTION
R.W. HELLWARTH, Univ. of Southern California, School of Engineering, *Los Angeles, California* 90007 (DF051200; AF-AFOSR-3479-78)

AF function - the University of Southern California has proposed a concept that could have tremendous impact on adaptive optics approaches to Air Force laser systems. These currently involve scanning detectors, interferometers, computers, servosystems and deformable mirrors. All of this hardware could be replaced by a nonlinear element at low power if the nonlinear refractive idea succeeds. Opportunity - nonlinear refraction may be able to generate an output optical beam which has conjugate phase from that of the input beam and the same frequency as the input beam. The important point is that if a laser beam is propagated through an atmosphere and reflected back to the receiver, then it will be subjected to an aberration by the optical path that it traversed. If this aberrant return is used as the signal into the nonlinear refractor the refracted signal would be the phase conjugate of the aberration. This could be injected into a high-power laser and phase locked so that the laser generates a beam at high power with conjugate phase of the aberrations in the optical path. Objective - to demonstrate 'proof-of-principle' in the visible using existing nonlinear materials. Contributions - the work provides an alternative to the adaptive optics approach to correcting distortions.

Efforts will be made to reduce pump power requirements from megawatts to kilowatts by both exploring resonant enhancement of the nonlinear index and modifications of beam interaction geometry. It is proposed that a narrow-band dye laser, to be pumped by a repetitive pulsed nitrogen laser, will be built and tuned near the resonances of various atomic vapors. They will build cells appropriate for containing sodium, rubidium, and potassium vapors as these appear to be the most promising media for experimentation in the visible.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0003, CHEMICAL AND VIBRATIONAL KINETICS OF NITRIC OXIDE IN COMBUSTION
R.K. HANSON, Stanford University, School of Engineering, *Palo Alto, California* 94305 (ENG76-08279 A01)

Research deals with the conversion of fuel-bound and atmospheric nitrogen to nitrogen oxides during combustion. The research will involve three components: (1) a shock-tube study of nitric oxide (NO) kinetics in gas mixtures containing model fuel-nitrogen compounds, (2) a program to develop tunable laser spectroscopy techniques for the measurements of species concentrations in combustion gases, and (3) completion of shock-tube research on the rate of reaction which controls NO formation from atmospheric nitrogen. In the first study, mixtures of nitric oxide and a model fuel-nitrogen compound, ammonia (NH3), will be shock-heated and spectroscopic measurements will be made of the concentration-time histories of critical species. The objective will be to develop a reaction mechanism which satisfactorily predicts the observed concentration-time histories. The research to develop tunable laser spectroscopy represents an application of recently developed tunable infrared diode lasers to measurements in combustion gases. These devices have great potential for nonperturbing, in situ measurements of species concentrations, including radical species, in combustion flows. The rate of formation of NO from atmospheric nitrogen is known to be controlled by the reaction N2 plus O yields NO plus N. Previously the value of the rate constant for this reaction had not been well known. As a part of this program, research will be completed to obtain accurate values of this rate constant, making use of a tunable CO laser to measure NO concentrations in shock-tube experiments. The research is a continuation of that done under NSF Grant No. ENG-7608279.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0004, DIAGNOSTIC TECHNIQUES FOR COMBUSTION MHD AND RELATED PLASMA FLOWS
S.A. SELF, Stanford University, School of Engineering, *Palo Alto, California* 94305 (ENG77-23932)

The research deals with the investigation and use of diagnostic techniques in three areas applicable to combustion magnetohydrodynamic (MHD) plasma flows. The areas include Langmuir probes, submillimeter interferometry, and an instrument for time-resolved temperature measurements applicable to ash-laden flows based on an extension of the spectroscopic reversal technique. The research program on Langmuir probes includes the following topics: (1) Test probe and sweep mechanism with clean fuels, and modify as necessary, to establish a viable operational technique for making in-channel measurements. (2) Compare electron concentrations measured with the probe to those derived by simultaneous submillimeter interferometer measurements, to obtain a check on the theoretical probe calibration. (3) Test the feasibility of using the probe in coal-fired MHD flows. (4) Utilize the probe to study and characterize the inhomogeneities and fluctuations in plasma flux at the entrance of the MHD generator section. Similar research will be conducted in the areas of submillimeter interferometry and the instrumentation for time-resolved temperature measurements. The research is a continuation of that supported under NSF Grant No. ENG-7304116.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0005, NEW FUELS DEVELOPMENT FOR SCRAMJET ENGINES
A.B. HARVEY, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN780314)

The objective of this proposal is to recommend an alternate fuel for a SCRAMJET missile which has a relatively low toxic vapor yet high volumetric heating value (1.2- 1.3 x 10 to the 6th power btu/cubic feet and short ignition delay times (approx. 0.1 ms).

The basic approach of this research effort is to use computer modeling to screen potential fuels with the above properties. The initial effort will be devoted to modifying the computer codes to include other combustion systems besides hydrocarbon fuels. The simplest fuel to check these codes is diborane combustion, which will be rapidly followed by pentaborane analysis. Once these systems are found to be satisfactorily modeled by the computer code, new fuels with low toxicity, high heat value and short ignition time will be screened by computer. Suggested fuels will be derived by modifying the chemistry of existing fuels with good combustion characteristics but high toxicity. Modifications include coordination complexing of the boron hydrides to produce a fuel with low vapor pressure and hence low toxicity. This approach, using computers to screen new fuels, should produce large savings in test fuel procurement and testing and costly synthetic development. Data from test facilities at Johns Hopkins Applied Physics Laboratory and other DOD-supported facilities will be constantly coupled with the calculations.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0006, MODULAR AVIONICS PACKAGING
R.H. HUSS, U.S. Navy, Avionics Facility, *Indianapolis, Indiana* 46218 (DN697009)

To provide a modular packaging definition compatible with the system partitioning requirements of future high-density electronics in high-performance platforms. An adequate modular packaging definition will permit the further development of standard functional modular packaging in a manner which can achieve simultaneously reasonable goals in high density, high reliability, adequate performance, and low life-cycle cost. Top-down functional partitioning is a key element in arriving at an adequate packaging definition.

Trade-off criteria will be established for packaging and functionality requirements. Based on packaging studies, including a determination of the requirements and constraints imposed by various avionics platforms, standard modules and higher level packaging systems (i.e., enclosures and racks) will be defined.

This task complements the packaging work under Agency Accession Number DN687502 by placing additional efforts on specific packaging requirements for high-performance aircraft.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0007, SUPPORT SERVICES FOR TECHNICAL PROGRAMS WITHIN THE RESEARCH AND TECHNOLOGY GROUP

UNKNOWN, Booz Allen & Hamilton Inc., *Bethesda, Maryland* 20014 (DN590213; N00019-77-C-0101)

To obtain support services for technical programs within the research and technology group.

Contractor to perform services in support of advanced systems requirements and research and exploratory development that are critical to future aircraft and weapon systems development programs.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0008, FURTHER DEVELOPMENT OF KC FILM/TONER

M.R. KUEHNLE, Coulter Information Systems, *Bedford, Massachusetts* 01730 (DN881286; N006-77-1849)

Continue work undertaken in contract N00600 76 C 0686 to develop an electrostatic photo printing and duplication system for use in aerial reconnaissance. This contract supports work unit ZT701, Accession No. DN781263.

Using the EN 109 modified under the previous contract, establish toner flow control and measure consumption and replenishment rate. Demonstrate methods of drying and fixation as a continuous process. Evaluate photometric and resolution capability. Demonstrate the feasibility of producing reverse image polarity as a continuous process.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Photographic Center

4.0009, METHODOLOGY FOR DESIGN OF FAULT-TOLERANT CONTROL SYSTEMS

A.S. WILLSKY, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (DN775270; N00014-77-C-0224)

Reliability has become of major importance for naval systems. This task has as its objective an overall design methodology for failure detection, isolation and accommodation, particularly for control systems.

Included in this task will be the development of analytic tools for the evaluation of system performance, a detailed study of the relative merits of different design strategies and the development of control strategies that can adapt to a number of actuator and sensor failures.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0010, MINI-REFRACTIONSONDE

C. MOTCHENBACHER, Honeywell Incorporated, *Minneapolis, Minnesota* 55413 (DN781460; N62269-76-C-0368)

Technical objective - demonstrate refractive index sonde for use on small vessels. This contract supports work unit RG703, Agency Accession No. DN581419.

Approach - provide mini-radiosonde packages and test for shipboard application.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0011, LASER BEAM DEGRADATION RESULTING FROM FLOW-INDUCED DENSITY FLUCTUATIONS

J.B. MILES, Univ. of Missouri, School of Engineering, *Columbia, Missouri* 65201 (DF051550; AF-AFOSR-3544-78)

AF function - weaponry. Opportunity - improve high-power laser design by providing quantitative understanding of laser beam degradation by propagation through a medium with turbulent density inhomogeneities. Objective - to select the optimum from among three competing theories for predicting beam degradation in turbulent flows. How work contributes -quantitatively reliable prediction of beam degradation in various circumstances related to high-power gas lasers and their use will lead to improved design of gas flow components and more effective choice of eventual combat doctrine.

Existing experimental data will be analyzed by computer, comparing results among three separate theoretical models.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0012, RPV LAUNCH/RECOVERY/SHIPBOARD COMPATIBILITY

K. MENACKER, U.S. Navy, Engineering Department, *Lakehurst, New Jersey* 08733 (DN696003)

To develop an optimum mini-RPV launch and recovery system for use on non-aviation type ships.

Survey the field to search out and identify the characteristics of the RPV, both established and planned, which relate to launch and recovery. Establish design parameters for a launch and recovery system. Design, manufacture, install and test a prototype launcher and recovery system. Establish firm launcher and recovery system specifications.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0013, AIRBORNE VELOCITY SENSOR TECHNOLOGY

R. DAY, Singer Company, *Little Falls, New Jersey* 07424 (DN781337; N62269-76-C-0471)

The objective of this task is to develop a full-function correlation velocity sensor. This work supports work unit ZC801, Agency Accession No. DN 781336.

A development model velocity sensor will be built to measure two dimensions of horizontal velocity, including hover, by the correlation technique. The sensor will be designed to operate over all terrains and water surface conditions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0014, 2-D SCHOTTKY IR ARRAYS

E. KOHN, Radio Corporation of America, *Princeton, New Jersey* 08540 (DF903300; F19628-77-C-0172)

The objective of this effort is to investigate the use of Schottky barrier infrared detectors with charge-coupled device readout. Large arrays of Schottky barrier infrared detectors with charge-coupled device readout will provide an inexpensive infrared imaging system. It will also bring about the reliability inherent to all solid-state systems. The contractor will optimize the design of a 25 by 50 array of Schottky barrier diodes with the associated transfer gates and CCD readout.

Four lots of two-dimensional platinum-silicide Schottky barrier infrared (IR) photosensing arrays with charge-coupled device (CCD) readout will be fabricated. The arrays will have processing changes made to optimize the infrared response. These changes will primarily concern the temperature of platinum-silicide formation and geometry changes to increase the breakdown voltage of platinum silicide Schottky barrier diodes on p type Si at 77 degrees K.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0015, TRESTLE WIND STUDY

UNKNOWN, Calspan Corporation, *Buffalo, New York* 14221 (DF190090; F29601-77-C-0093)

The purpose of this work is to identify and study by means of a wind tunnel analysis unique wind flow characteristics at the trestle EMP facility and the implications of these flows upon safe aircraft testing procedures.

A wind-tunnel study of wind flow utilizing a detailed model of the trestle will provide data for a detailed flow analysis to determine the effects of the terrain and the facility on the general flow

pattern and to identify those flow patterns that might yield high-risk test situations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Weapons Lab.

4.0016, COMMUNICATIONS - NONLINEAR AND TURBULENT WAVE INTERACTIONS
N. MARCUVITZ, Polytechnic Inst. of New York, School of Engineering, *Farmingdale, New York* 11735 (DN723110; N00014-76-C-0176)

Navy and DOD communications and navigation systems such as fleet SATCOM, TRANSIT, and NAVSTAR GPS which rely on transionospheric radio propagation are subject to amplitude, phase, and angle scintillation which degrades system performance. Fundamental research on radio propagation through plasma irregularities based on advances in understanding the nature of the plasma instabilities responsible for the irregularities could lead to optimum coding or modulation of the radio waves to minimize loss of information.

The growth and saturation of plasma instabilities in the ionosphere will be studied using nonlinear kinetic theory to determine the correlation spectrum of electron density fluctuations. The propagation of electromagnetic waves through the turbulent ionosphere will be examined. Nonlinear electromagnetic-ionospheric interaction mechanisms for ordinary and extradordinary mode processes that lead to turbulent heating and particle diffusion effects will be examined using kinetic quasi-particle techniques.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0017, ELECTRONIC AND DATA SYSTEM DEVELOPMENTS FOR AERODYNAMIC TESTING
D.V. BREITENBECHER, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF141560)

The conception and generation of effective weapon systems must first be preceded by extensive operational testing in aerodynamic wind tunnels to achieve optimum design. These facilities include the 50-megawatt RENT and HTL facilities, the TGF and others. The objective of this work unit is to apply unique developments in electronic circuitry and systems to improve performance, reliability and cost-effectiveness of the existing facility data systems as well as those data systems now under development. The application of these techniques to control, monitor, and read facility parameters as well as control the facility will improve the performance, reliability, and cost-effectiveness of the facility.

The facilities will be screened to determine the improvements required and the priority of these improvements. Data systems of existing facilities will be updated via the application of new micro electronic and computer technologies. The monitoring, reading, and control of critical facilities will be updated by application of the above technologies. Where applicable these techniques will be used as new facilities are planned and developed. New devices for facility diagnostics and control, such as the electron beam, will be designed, tested, and installed to increase data reliability. Modern and more reliable hard-wired systems will be developed in-house or purchased, tested and installed where applicable.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0018, APPLIED AERODYNAMICS OF WIND TURBINES
R.E. WILSON, Oregon State Higher Educ. Sys., School of Engineering, *Corvallis, Oregon* 97331 (EY-76-S-06-2227)

New research will concentrate on the unsteady aerodynamics of the Darrieus rotor as they affect rotor blade stresses, and completion of aerodynamics studies of the Savonius rotor. A flow analysis of a wind turbine operating in the region of the windmill brake state (entrance to which requires a blade angle very close to that required for maximum performance) will be performed to enable the prediction of turbulence or unsteadiness. The study will also investigate the potential advantage of adding a small airfoil (or tip vane) to the tip of a wind turbine blade. (ERDA-77-32)

SUPPORTED BY U.S. Dept. of Energy, Div. of Solar Technology

4.0019, SINGULAR PERTURBATION TECHNIQUES FOR SYSTEMS WITH HIGHLY COUPLED DYNAMICS
A.J. CALISE, Drexel University, School of Engineering, *Philadelphia, Pennsylvania* 19104 (DN775636; N00014-77-C-0642)

Singular perturbations have been applied in control theory to reduce the order of large linear systems to a set of smaller, more easily handled systems. However, for nonlinear systems, the approach is still not useful either for performance evaluation or for real time implementation. The objective of this task is to extend the applicability of the method for use in analyzing problems of flight mechanics and control.

A multiple boundary layer procedure will be extended to include cases in which the system dynamics and the performance index are dependent on the slow states. This would greatly enlarge the range of problems for which singular perturbation techniques are accurate.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0020, RESEARCH ON POLYVINYLIDENE FLUORIDE (PVF) TRANSDUCERS FOR NONDESTRUCTIVE TESTING (NDT) APPLICATIONS
W. SCOTT, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN881177)

(1) to determine the feasibility of using polyvinylidene fluoride (PVF2) as an active transducer element for NDT applications (e.g., pulse echo transducers, surface wave transducers and transducer arrays). (2) to evaluate the advantages of cost reduction, weight reduction and increased flexibility gained by replacing ceramic transducers with PVF2 transducers.

Fabrication techniques will be developed for incorporating PVF2 films into various types of conventional and beam forming transducers. A number of mechanically flexible transducers will be fabricated for use in the inspection of parts with complex geometries such as compound curvatures. These transducers will be evaluated for materials and components for which they may be particularly suitable (e.g., airfoils and fir tree sections of turbine blades, composite materials, ceramics).

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0021, WIND-TUNNEL TESTS OF DEMO ROCKET
UNKNOWN, U.S. Air Force, Arnold Engin. Dev. Center, *Tullahoma, Tennessee* 37389 (DA0G1011)

To perform aerodynamic design of low-cost rocket.

Wind-tunnel tests will be performed on free rocket configurations.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Free Flight Rocket Technical Office

4.0022, ANALYSIS REQUIREMENTS FOR ANTHROPOMETRIC SURVEYS
H.F. MARTZ, Texas Tech University, School of Engineering, *Lubbock, Texas* 79409 (DN796403; N63126-77-M-0154)

The objectives will be: (1) to investigate factor analytic techniques for reducing the number of variables required for characterizing anthropometric populations; and to (2) investigate techniques for efficiently estimating percentiles of anthropometric populations.

Various procedures for reducing the numbers of variables will be investigated including: (1) principal components and (2) stepwise factor analysis. Four sets of empirical data will be used in this part of the study: (1) USN aviator data - 1964; (2) USAF flight personnel -1970; (3) USA aviators - 1970; and (4) Monte Carlo data. For the percentile estimation objective, at least four methods will be investigated: (1) direct estimation; (2) Pearson

distribution estimation; (3) empirical distribution fitting; and (4) normal approximation. Again the four data sets delineated above will be studied with these four methods. Appropriate error measures such as bias, variance, and mean square error will be calculated for each of the investigations within this effort.

SUPPORTED BY U.S. Dept. of Defense, Navy, Pacific Missile Test Center

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, THEORETICAL STUDIES OF AURORAL AND MAGNETOSPHERIC PHENOMENA
D.W. SWIFT, Univ. of Alaska, Geophysical Institute, *Fairbanks, Alaska* 99701 (ATM77-14897)

This grant will support a broad range of theoretical studies directed toward answering fundamental questions about the auroral magnetospheric substorm and the mechanisms of energy flow from the solar wind to the aurora. The work will consist of an interplay of analytical studies and numerical modelling of plasma processes.

Specific projects planned are: 1. an investigation of the mechanism for the development of large localized potential differences across magnetospheric field lines; 2. an investigation of energy transfer processes through the northern and southern boundaries of the magnetospheric tail; 3. an improved V-shock model to calculate perpendicular energization of oxygen ions and 4. an investigation of wave-particle diffusion processes in auroral electron beams.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0002, MATERIALS PIT INVENTORY
B. KAY, State Materials Services, *Phoenix, Arizona* 85007 (100544 (HRB NO.))

An inventory of all known and potential sources of rock and aggregate in Arizona is being made. A geological investigation by means of air-photo analysis of selected areas is supplemented by field investigation to verify data, to make a photogeologic map of each area studied, to evaluate the rock and aggregate listed on the data sheet for each area, and to make descriptive reports by counties. Also included are current land status maps and index maps of aerial photograph and USGS topographic map coverage. Pit information is being transferred to punched cards for automated storage and retrieval.

SUPPORTED BY U.S. Dept. of Transportation, Federal Highway Admin.

5.0003, THE NORTH PACIFIC EXPERIMENT - NORPAX - AIRCRAFT PHASE OF THE EQUATORIAL SHUTTLE
B. BEAN, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (OCE77-24147)

This project is part of the North Pacific Experiment (NORPAX). The long-range goal of NORPAX is to understand fluctuations in the upper layers of the Pacific Ocean with time scales of months to years and space scales in excess of 1,000 kilometers, and the relationship of these oceanographic fluctuations to the overlying and adjoining atmosphere. Achievement of this goal should eventually lead to improved weather/climate prediction for both the Pacific Ocean and North America.

This specific grant to NOAA will provide part of the operating costs for the NOAA P3 aircraft to be used by Drs. Bean, Patzert and Barnett in their studies of the oceanic temperature structure and the associated atmospheric fluxes in the Equatorial Pacific. NOAA will support Dr. Bean's research and the remaining part of the aircraft costs. The NSF is supporting the research by Drs. Patzert and Barnett through grant 0OCE76-80183.

SUPPORTED BY U.S. National Science Foundation, Div. of Ocean Sciences

5.0004, LAGRANGIAN CURRENT MEASUREMENTS FOR PHASE I OF THE NORPAX EQUATORIAL PROGRAM
D. HANSEN, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (R3331318)

PROJECT OBJECTIVE: To obtain Lagrangian current data in the region of the Equatorial Counter Current, for the Test Shuttle Project of the NORPAX Equatorial Program.

CURRENT YEAR PLAN: Drift buoys will be deployed in the tropical Pacific Ocean to observe surface currents in relation to the temperature and density distribution. Buoy position data will be collected by means of the NIMBUS-6 satellite (NASA), and processed and interpreted at AMOL. The primary experimental period is to be from November 1977 to March 1978, but the buoys are likely to continue operation into summer, 1978.

PROGRESS REPORT: Buoy hardware has been specified and hardware procurement contract has been let. Data processing system has been completed, and logistic details are being arranged.

SUPPORTED BY U.S. National Science Foundation, Unspecified Unit

5.0005, N43RF MAINTENANCE
J.D. MCFADDEN, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8G172143)

PROJECT OBJECTIVE: Provide for maintenance on WP-3 aircraft. Regularly scheduled checks; engine and prop changes; structural repair, tires; navigation and aircraft electronic systems; spare parts required to carry out maintenance procedures.

CURRENT YEAR PLAN: To maintain WP-3D in a high state of readiness for hurricane research and reconnaissance missions, oceanographic and air-sea interaction flights and fisheries research programs, through an intensive maintenance program that includes daily and 200 hour inspections, engine performance, run-ups and aviations, electronics and navigation systems flight tests.

PROGRESS REPORT: Normal maintenance and inspections were performed.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0006, STUDENT RESEARCH
A. SMITH, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8DJ41190)

Research effort directed towards processes for solar-terrestrial phenomena to aid in the prediction of time and spatial occurrence of solar disturbances and their effects on the solar-terrestrial and near-earth environment.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0007, GEOPHYSICAL MONITORING FOR CLIMATIC CHANGE - MAUNA LOA
J. WATKINS, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8FK20140)

PROJECT OBJECTIVE: The Geophysical Monitoring for Climatic Change program (GMCC) will provide information necessary to predict climate due to changing levels of trace material in the atmosphere. Subsidiary objectives include: a. Establishment of a network of 'clean' air monitoring observatories; b. Develop precision quality control techniques; c. Relate concentration of trace materials to weather and climate patterns.

CURRENT YEAR PLAN: Continuation of precision measurements of carbon dioxide, solar radiation, carbon monoxide and aerosols. Institution of routine lidar measurements for stratospheric aerosol. Develop program-wide aerosol monitoring instrument system. Install computer-oriented data management system. Conduct research on the chemical nature of aerosols in the Mauna Loa area. Determine the feasibility of using a dye laser for vertical ozone.

PROGRESS REPORT: Mauna Loa lidar observations are monitoring a stratospheric dust cloud resulting from the October

1974 eruption of Fuego volcano in Guatemala. Analysis of this event is continuing and includes solar aureole and received solar radiation data. Initial design and construction of portable lidar system has been completed. New aerosol monitoring equipment is being tested. A local precipitation network has been established.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0008, POTENTIAL FIELD THEORY AND INTERPRETATION

B.K. BHATTACHARYYA, U.S. Dept. of The Interior, Geological Survey, *Denver, Colorado* 80225 (8-9730-01999)

The major goals of the project are quantitative interpretation of crustal magnetic anomalies at satellite altitudes and development of a method for the interpretation of three-component magnetic data.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0009, ENVIRONMENTAL MASS SPECTROMETRY

L.W. SIECK, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234 (3163131)

PURPOSE: To conceive, develop, and exploit novel techniques pertinent to EPA, NOAA, and NASA atmospheric and water pollution measurement and modelling programs.

OBJECTIVES: To conceive, fabricate, and bench-test a tractable system for rapid (sub-minute) analysis of water pollutants using unique in-house instrumentation and utilizing gas-phase ion chemistry as a detection techique.

FY 77 MILESTONES: 12/31/76--Complete experimental portion of CO2 measurements pertinent to gas-cooled reactor corrosion, industrial laser development, and Martian atmosphere. Prepare manuscripts and reports. 1/1/77--Initiate experimental program to test new in-house developed concept for analysis of high molecular weight hydrocarbon pollutants and carcinogens in water using the modified NBS high-pressure photoionization mass spectrometer as detection system.

ACCOMPLISHMENTS: An extensive effort was undertaken to discover and quantify the role played by trace impurities in the ionic decomposition of gaseous CO2.

Ionic fragmentation patterns were determined for a variety of atmospheric constituents for calibration of atmospheric sampling devices.

A feasibility study was completed, and preliminary measurements taken, for development of novel, direct analysis procedure for hydrocarbon eluates from liquid chromatographs.

SUPPORTED BY U.S. Dept. of Commerce, National Bureau of Standards

5.0010, STRATOSPHERIC ANALYSIS DEVELOPMENT

UNKNOWN, U.S. Dept. of Commerce, Natl. Meteorological Center, *Washington, District of Columbia* 20023

OBJECTIVE: To produce improved analyses of the neutral atmosphere from 70 mb to 0.4 mb.

STATUS: Operational analyses at 70, 50, 30, and 10 mb are produced by a Cressman type analysis system at 1200 GMT daily. The system has been tuned to stratospheric radiosonde data. Satellite retrieval data from VTPR have been examined and found unsuitable for these analyses.

Analyses at 5, 2, 1, and 0.4 mb are produced by a modified Cressman system on a weekly basis and with the use of rocketsonde and satellite radiance data.

PLANS FOR FY78: (1) Day-night difference studies of radiosonde data for a two-year period will be completed and a new set of temperature and height adjustments derived. (2) The feasibility of using presently developed tropospheric optimum interpolation analysis methods as a basis for a new stratospheric analysis system will be investigated. (3) The feasibility of using TIROS N data for all stratospheric analyses will be investigated. (4) Evaluation and modification (when necessary) of the higher level (5 to 0.4 mb) analysis system will continue.

Part 7 of 8.

SUPPORTED BY U.S. Dept. of Commerce, National Weather Service, National Meteorological Center

5.0011, PHYSIOGRAPHIC CLASSIFICATION OF SOUTHERN PINE FOREST LANDS

J.T. MAY, Univ. of Georgia, Agric. Experiment Station, *Athens, Georgia* 30601 (0060780; GEO-0025-MS-F)

OBJECTIVE: Organize physiographic land patterns into a system having significance and utility for resource managers. Develop a physiographic map of southern region using the new system.

APPROACH: Current information on physiography, soils, and surface geology related to forest vegetation will be analyzed and coordinated. Localized information will be reorganized to form a unified regional system. Map development will be on a state basis, utilizing local authorities, aerial photography, and space imagery when appropriate.

PROGRESS: A basic physiographic map of Georgia was completed, using ERTS imagery and data from the Georgia Geological Survey. The finished map of Georgia will be an ERTS photograph mosaic with county lines and land forms drawn in. Maps for Alabama and Mississippi are almost complete.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Georgia

5.0012, RESOURCE AND RADIOACTIVITY SURVEY IN ANTARCTICA BY AIRBORNE GAMMA-RAY SPECTROMETRY

E.J. ZELLER, Univ. of Kansas, School of Liberal Arts & Sci., *Lawrence, Kansas* 66045 (DPP77-21504)

The University of Kansas will continue a survey of radioactivity in Antarctica. A primary aim of this research project is the understanding of the distribution and concentration of radioactive elements in the different rock strata and in different tectonic environments. The research will also be important for the evaluation of ice-free areas as potential sources of radioactive-energy sources. During the initial phases of the project, special equipment was purchased, modified, tested, and adapted to use in the field with equipment already available at the University of Kansas.

Field research during the 1977-78 field season (under DPP76-23441) will be in 1) the ice-free areas of the McMurdo region, where reference ground lines will be surveyed for radioactivity and the instruments then calibrated from the air over the reference lines, and 2) in the Marie Byrd Land Coast Area, where Pre-Cambrian to Mesozoic age plutonic and metamorphic rocks and Tertiary age volcanic rocks will be surveyed. During the 1978-79 field season, a reconnaissance aerial survey by helicopter, begun during 1976-77, will be completed of the ice-free areas in the McMurdo regions, and the region of the Darwin Glacier and Dufek Intrusion will be surveyed. Projected future areas of research are for 1979-80, Ellsworth Mountains; 1980-81, Northern Victoria Land; 1981-82, Pensacola Mountains; 1982-83, Coastal Mountains in East Antarctica.

Three scientists from the University of Kansas will do field work in the McMurdo area, Antarctica, during the 1978-79 field season. They will be accompanied by a scientist from the Federal Geological Survey of West Germany.

SUPPORTED BY U.S. National Science Foundation, Div. of Polar Programs

5.0013, SYSTEMS DEVELOPMENT AND EXPERIMENTATION - FORECASTER AIDS AND APPLICATIONS

H.M. ONEIL, U.S. Dept. of Commerce, Integrated Systems Laboratory, *Silver Spring, Maryland* 20910 (8C27037)

TECHNICAL OBJECTIVE: To integrate forecaster aid and application programs into the AFOS software at WSFO's, WSO's and RFC's.

APPROACH: Translate results of techniques development into AFOS compatible software programs. Analyze man-machine interaction and optimize software through experimentation. Develop multi-position operating system.

PROGRESS: 1. Aviation Monitoring and Updating: This forecast applications program automatically monitors and helps

update aviation terminal forecasts (FT). The AFOS minicomputer compares each incoming surface aviation observation (SA) to its terminal forecast and alerts the forecaster with a message if the SA contradicts the FT or approaches FT amendment criteria. In September 1977 a limited experiment was conducted to test this program. The results showed no serious problems. 2. Computer Worded Forecast (CWF): The CWF program produces public forecasts using objective numerical guidance derived from the Model Output Statistics. Forecast parameters are precipitation, wind, clouds, and temperature for three 12-hour periods: today, tonight, tomorrow. The objective of the experiment is to evaluate the wording of the forecast produced from the digital guidance. 3. Radiosonde Observation Plots: A set of routines for AFOS plotted radiosonde observations on a thermodynamic background was developed for early use. 4. Centralized Archival System: Under AFOS, field offices will no longer routinely make hard copies of the observations and forecasts they produce. A Central Archival System to retain and retrieve data is being designed. 5. Subroutine Library: A subroutine library was created for AFOS. It contains over 125 different subroutines that are commonly used in scientific computations. 6. Digital-to-Voice Readout of Computer-Generated Weather Reports: The feasibility of a computer-generated voice system to replace recorded voice dissemination by using computer processable weather information which would automatically be converted to speech has been studied with emphasis on the NOAA Weather Radio application. The study concluded no 'off-the-shelf' system, with output speech that is acceptable to the general public, is available today. The quality and intelligibility of one corporation's output speech is sufficiently good to test on the public.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service

5.0014, AUTOMATION OF VISUAL PRESENT WEATHER OBSERVATIONS

H.A. BROWN, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF581570)

AF function - weather observations for military operations. Deficiency - present methods are wasteful of manpower resources and deficient in the application of available automated weather observing and data acquisition technology. Objective - to develop techniques to automate the visual observation of existing weather conditions using an array of weather instruments. How development contributes - makes possible the real-time use of state-of-the-art meteorological and data acquisition technology in operational weather observing.

Utilizing data from an automated array of weather instruments, develop a prototype computerized decision-tree model that will unambiguously select the type and intensity of the present weather, i.e., heavy snow, moderate rain, light drizzle, fog, etc., test this model and compare it with independent data collected during a one-year period at the AFGL Otis Weather Test Facility, evaluate the results and expand or refine the model as required.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0015, MICROPROCESSOR APPLICATION FOR SOUNDING ROCKET INSTRUMENTATION

J.R. GRIFFIN, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF580660)

AF function - development of instrumentation for Air Force research vehicles. Deficiency or opportunity - telemetry instrumentation required for field use and remote operational areas require more effective capabilities prior to and during flight of research vehicles. A reliable pulse code modulation decommutator is required for data analysis prior to vehicle launch. A universal pulse code modulation simulator is required for system(s) test prior to vehicle flight. During flight of research vehicles, trajectory displays are not adequate. Objective - apply state-of-the-art microprocessor technology to develop a new generation of ground-based instrumentation and tracking systems. How research contributes - instrumentation and techniques developed will provide improved testing procedures of research vehicles prior to flight. Improved real-time data analysis capability will provide reliable and effective prelaunch go/no-go decision criteria at remote launch sites. Improved trajectory displays will allow inflight correction of ground-controlled vehicles at remote launch areas.

A study will be made as to which criteria should be used for each type of instrumentation - microprocessor plus software design, or a combination of software and hardware design. A team approach will be taken to develop basic requirements. Based upon best approach, a pulse code modulation decommutator will be developed for field use. The necessary software and hardware will be developed. A similar progression will be taken for the pulse code modulation simulator and real-time trajectory display instrumentation. Upon completion of feasibility designs, the instrumentation will be fabricated in suitcase-size units and tested during field operations of opportunity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0016, SEASAT SATELLITE ALTIMETRY

G. HADIGEORGE, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF581400)

AF function - use of altimetric data for the estimation and refinement of the earth's gravity field. Deficiency - lack of more precise data contributes to geodetic and gravimetric missile guidance errors. Objective - determine the accuracy with which the global geoid and earth's gravity field can be estimated from altimetric and gravimetric observations using rigorous mathematical techniques. How research contributes - improvement in the mathematical model and better representation of the global geoid and geopotential will reduce geodesy and gravity contributions to missile guidance errors.

Mathematical algorithms will be tested and/or modified for highly efficient data processing, so that detailed gravimetric features in regions with abundant GEOS-3 and SEASAT altimetric data may be extracted. Using the newly developed algorithms, conduct SEASAT studies, computer analyses, and evaluations to determine the most efficient procedure.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0017, SATELLITE DENSITY MEASUREMENTS USING IONIZATION GAUGE INSTRUMENTATION

J.P. MCISAAC, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF581200)

AF function - low-altitude, operational satellites, airborne surveillance, ballistic nuclear weapon delivery. Deficiency -inaccuracies in the determination of low-altitude satellite ephemerides due to inadequate data on density variation at critical altitudes. Objective - acquisition of atmospheric density measurements on a global scale, to define, correlate and/or relate results empirically with solar and geophysical phenomena. How research contributes - permits direct accurate measurements of density providing inputs to be used in the development and upgrading of forecasting techniques.

Ionization gauge instrumentation will be flown onboard the S77-2 spacecraft providing measurements of atmospheric neutral density during the 1978 calendar year, a year in which solar activity is on the increase approaching its maximum peak period. Instrumentation using ionization gauges also include a motor activated air stream modulator. These S77-2 flight units are capable of direct measurement of atmospheric gas density but will also be flight-tested for potential applications as atmospheric gas temperature monitors. Data acquired in this flight will be utilized and merged with the S3 satellite density data base for use in empirical studies as well as analysis and correlation investigations of a statistical nature.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0018, ATOMIC OXYGEN ION LOSS RATES

W. SWIDER, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF581060)

AF function - communications. Deficiency - inadequate knowledge of F-region after a nuclear explosion will impact satellite communications. Objective - to improve knowledge of atomic oxygen ion loss rates. How research contributes - determination of accurate atomic oxygen ion loss rates, especially at high temperatures will help improve communication codes at MF-HF-VHF-UHF after a nuclear detonation in the F-region.

Atmospheric data from the nasa atmosphere explorer satellites will be assessed with the aim of determining if there is information pertinent to F-region communications problems, particularly the atomic oxygen ion loss rate with molecular nitrogen at high temperature, which is a principal ionization loss mechanism for the F-region.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0019, FEASIBILITY OF SENSING ATMOSPHERIC OPTICAL PARAMETERS AT TACTICAL ALTITUDES

R. TOOLIN, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF580240)

AF function - electrooptical offensive/defensive weapon delivery, optical guidance, communications. Deficiency - lack of a flexible mobile system to respond to potential field-test needs of AF system hardware development groups. Insufficiency of IR optical atmospheric profiles to verify and to improve transmission and scattering codes. Objectives - to define and to specify the mobile field instrumentation and operational techniques necessary to obtain from the ground vertical profiles of the optical characteristics of the atmosphere to tactical operating heights of 3-5 km. How research contributes - by improving the definition of the atmosphere as the optical medium in which the increasingly sophisticated AF electrooptical systems will operate.

Specification of the system will be developed - from a literature survey, both technical reports and manufacturers, brochures, from interviews of the 'gatekeepers' (repositories of the practical technology), from limited laboratory tests to verify potential techniques and instrumentation. The results will be controlled by these factors: projected technical and operational value of the data, resource requirements, system mobility, existing technology only.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0020, SIGNAL STATISTICS OF INTENSE SCINTILLATIONS

H.E. WHITNEY, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF580930)

AF function - satellite communications. Deficiency - inadequate knowledge of the effects of ionospheric scintillations on trans-ionospheric radio propagation. Objective - study the signal characteristics of intense scintillation and relate the effects on the propagation path to the performance of satellite communication systems. How research contributes - with a better knowledge of the degradation that can be expected on the communications path from scintillations, mitigating techniques can be implemented to improve the reliability of satellite communications.

The data recorded in Peru during October, 1976, and March, 1977, on intense scintillations will be computer processed to provide the required signal statistics. Additional testing will be done in March, 1978, to expand the data base on equatorial scintillations. Data from three closely spaced receiving sites will be used to determine the spatial correlation and the feasibility of space diversity for AFSATCOM. Power spectra from ground station data will be compared to aircraft data to determine the effects of the planes velocity on the scintillation rate. The basic analysis for signal statistics was developed under IHWU 46430103 and the work unit is an extension of that effort.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0021, OPTICAL OBSERVATIONS OF DEEP SPACE OBJECTS

S.P. WORDEN, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF580810)

AF function - communications, surveillance, detection, tracking. Deficiency - inadequate knowledge of solar environment, disturbances, and physics limits ability to predict events which disrupt and degrade AF systems. Objective - to test and perfect necessary hardware and software for use with large astronomical telescopes to produce high-resolution data on earth-orbiting satellites. How research contributes -successful implementation of satellite surveillance utilizing the full high-resolution capability of large astronomical telescopes will extend Air Force capabilities in the surveillance and monitoring of satellites by a factor of at least 50 in spatial resolution. Moreover, the extension of these techniques for use on newly developed and proposed multiple mirror telescope systems would increase this capability by up to a factor of 500. The impact of these image reconstruction systems on task objectives will be to provide higher resolution images of solar features than available with present equipment.

Instrumentation currently being developed under the Lab Director's Fund, Project ILIR7A01 will be used to determine the limiting brightness of objects for which high spatial resolution information can be obtained. Towards this end a variety of test targets (satellite and solar system objects) will be studied, utilizing University of Arizona equipment and telescopes to be provided under contract with Arizona. Orbits for selected satellite test targets are to be provided by the Aerospace Corporation. Studies incorporating the new University of Arizona multiple-mirror telescope (scheduled for completion in 1978) will determine whether multiple mirror telescopes may be used to obtain speckle interferometry data. This new instrument has an aperture equivalent to a conventional 7-meter telescope, and exceeds by a factor of 1.5 the largest existing telescope. It is the prototype for a class of new telescopes which may eventually exceed 30 meters in diameter. Such telescopes could, in principle, detect spatial structure smaller than 1 meter in extent on a satellite in synchronous earth orbit. Harvard University will develop, under contract, advanced image processing techniques for application to extended objects like the solar surface and larger satellites.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0022, GLOBAL STORM INDEX

R. MARKSON, Airborne Research Associates, *Weston, Massachusetts* 02193 (DN475450; N00014-74-C-0336)

Development of a global thunderstorm index that can eventually be used to verify the coupling mechanism between a solar and a terrestrial event (e.g., increase in electric field and air-earth current after a flare) is the immediate objective of this research. The ultimate objective is extension of the Naval Weather Forecast to five days or so.

Using color-enhancing equipment with a built-in optical planimeter, the grey scale of black-and-white photos of clouds taken from the Geocentric Orbit Earth Satellite, GOES, will be mapped for western Africa and South America and the Atlantic Intertropical convergence zone in between. Resources permitting, data will also be used from the GOES over the Pacific to map the cloud area over Indonesia, a major thunderstorm area of the earth.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0023, STRATOSPHERIC DIFFUSION OF POLLUTION

J.L. LARSON, Hycor Incorporated, *Woburn, Massachusetts* 01801 (DF580510; F19628-77-C-0136)

AF function - provide environmental assessments of Air Force systems which operate in and through the stratosphere. Objective -improve the precision of estimates of the environmental impact of AF flight operations in the stratosphere. Deficiency - existing data on pollution lifetimes, at best, represent a global mean with no estimate of variances. How research contributes - a smoke release system to deposit small puffs of smoke at stratospheric altitudes from a balloon platform will be developed. An optical sensor system (TV and cameras) on the balloon will observe the time history of the smoke puff and provide the time history of the turbulence structure at the altitude of release. This effort is for the development and flight of the smoke puff system which will be flown at various altitudes and geophysical locations.

Small frangible canisters are packaged into a dispensing system that can release smoke in a controlled manner a known distance below a balloon platform. The puff history, after release, is observed by TV and camera systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0024, THE USE OF REMOTE-SENSING TECHNIQUES FOR THE DETECTION OF CROP STRESS (DISEASE AND WATER)

G.R. SAFIR, Michigan State University, Agric. Experiment Station, *East Lansing, Michigan* 48823 (0059700; MICL01077)

OBJECTIVE: Identify the major spectral and structural canopy components which contribute to the directional spectral reflectance of wheat, corn, sugarbeet, bean and soybean canopies suffering from disease and water stress. Calculate the theoretical detectability, using a mathematical directional reflectance model, of each of the above diseases for operational remote sensing systems and possibly for systems as yet undeveloped. Determine the relationship between aerial photographic ratings of diseases fields and crop yield.

APPROACH: For each canopy type, samples will be grown in the greenhouse and/or field and/or growth chamber. The biological and spectral canopy components will be measured throughout the growth cycle and analyzed. Control and stressed sample plants will be used for calculation of the spectral reflectance of a large area canopy by use of a mathematical canopy model. If the calculated canopy reflectances agree with canopy reflectances as measured in the field, then the canopy model will be used to estimate the importance of the individual canopy components to the canopy reflectances.

PROGRESS: Aerial infrared (IR) photography was used for determining the levels of Rhizoctonia root rot and black rot disease (Aphanomyces sp) of sugarbeets in the field. Significantly high correlations were found between photos ratings of disease intensity and plant vigor and preharvest ground estimates of disease severity and yield. Photo estimates of these diseases are now being used in sugarbeet breeding trials. Photo estimates of wheat spindle streak mosaic (WSMD) disease correlated significantly with ground estimates of disease intensity as well as with yield. Chlorosis levels determined using aerial photography and ground observations also were significantly correlated with yield. Initial WSMD ratings correlated significantly with increased chlorosis levels due to other stresses. Relative standing biomass was estimated, using aerial photography, for an old field ecosystem that received measured levels of wastewater irrigation. Correlations between harvested biomass and photo estimates of biomass were highly significant.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Michigan

5.0025, SURVEY TECHNOLOGY DEVELOPMENT

A. KEMMERER, U.S. Dept. of Commerce, Natl. Oceanic & Atmos. Admin., *Bay St. Louis, Mississippi* 39520 (SEC-207)

Overall objective is to provide technical options for achieving NMFS goals through satellite and remote sensing applications, development of sampling and data management systems, program planning (system engineering), and technology transfer and coordination. Satellite studies include SEASAT-A surface layer transport and fisheries surveillance, CZCS fishery applications, satellite tracking of porpoises and marine turtles, and development of satellite image analyses, remote sensing applications including photography and LLLTV demonstrations and support of RUFAS-II sampling systems including turtle and porpoise tags, turtle tracking, porpoise containment system design, and development of trawl door STD. Data management efforts relate to EPA studies, SEFC data, and optimized cruise tracks; program planning includes SEFC turtle PDP support, and planning support for NOAA. Technology transfer and coordination impacts the national focus of NFEL and includes NOAA technical management of CZCS program, NMFS coordination of SEASAT projects and support of ICES aerospace remote sensing group.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Marine Fisheries Service

5.0026, ENERGY INTERACTIONS IN MESOSCALE SYSTEMS

G.L. DARKOW, Univ. of Missouri, Agric. Experiment Station, *Columbia, Missouri* 65201 (0057261; MO-00312)

OBJECTIVE: Observe and analyze the flow and thermodynamic interactions of mesoscale-convective storm systems and the larger scale atmospheric systems which sustain them. It is anticipated that this observation and analysis will yield an improved understanding of the life cycle of severe convective systems which in turn will yield improved forecast and warning techniques.

APPROACH: Selected surface, upper air, radar and satellite data from the archives of the National Climatic Center, the National Severe Storm Lab., the National Center for Atmospheric Research and the forthcoming Project SESAME will be locally processed, combined, and analyzed using mesoscale-numerical analysis methods developed at this institution.

PROGRESS: The first comprehensive study of the extent of mobile home damage and resident injuries due to windstorms in the State of Missouri has been completed. Damage, injury and death statistics covering a six-year period (1970-1975) indicate that although mobile homes represent only 3.5% of the total housing units in the State, over 50% of the wind-caused deaths and injuries occurred to residents of mobile homes. Over 50% of the dwelling units destroyed by high winds and tornadoes in Missouri were mobile homes. The continued explosive growth of mobile home residency in Missouri and other states suggests that this facet of the total wind damage and injury problem will be increasingly important over the next decade. A new study has been started which will attempt to more clearly define the unique properties of the atmosphere which must develop for short periods of time and over relatively small areas which allow tornado-bearing storms to form as opposed to non-tornadic thunderstorms. Hourly surface meteorological observations from stations experiencing tornado formation within 10 miles are being compared with simultaneous observations at all available surrounding surface stations. If it is possible to detect wind, temperature, and moisture conditions that are unique to the immediate area in which subsequent tornado activity developed, then these conditions can be incorporated in improved short-range tornado forecasting techniques.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Missouri

5.0027, AN INVESTIGATION OF ELECTRIC FIELDS IN THE TIME-DEPENDENT MAGNETOTAIL

C.H. MURPHY, Kean College of New Jersey, Graduate School, *Union, New Jersey* 07083 (ATM78-11763)

The research supported here is an extension of work carried out under NSF Grant ATM75-1734201. The objective of the research is to obtain a clearer understanding of the temporal behavior of the electric field in the earth's magnetotail. Of special interest is the induced electric field and its relationship to electric fields produced by charge separation.

It is recognized that the magnetotail is a composite of several different modes of current conduction, and the role of the electric field in driving these currents varies. Hence, the temporal behavior of the electric field may well be different in the various regions of the magnetotail.

This work proposes to study the major current modes in the tail and solve them for the time-dependent case. Previous work on a simple neutral sheet model has added considerable insight to this approach. All systems will be solved self-consistently so that neither the induced or charge separation components of the electric field will be ignored.

After the separate elements of the tail current system have been studied, it will be necessary to tie them together in a reasonable fashion to simulate to total tail current. This synthesis will be done in the context of a model that will allow the variation of the electric field in the tail to be related to conditions external to the magnetosphere, i.e., solar influences.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0028, TSUNAMI NETWORK SUPPORT

H.E. CLARK, U.S. Dept. of The Interior, Geological Survey, *Albuquerque, New Mexico* 87106 (9920-01263)

STATES TO WHICH PROJECT PERTAINS: New Mexico and California.

The objectives to be sought in the current fiscal year are to operate Tsunami Tide Systems and the Tsunami Seismic Systems over the GOES SMS satellite network. The Tsunami Tide Systems will be operationally evaluated in an actual NWS facility located in La Jolla, California. The Tsunami Seismic Systems will be operationally evaluated in a realistic system configuration at the Albuquerque Seismological Laboratory, Albuquerque, New Mexico. Various parameters in the event detection and validation unit will be tested for optimum event detection for various types of earthquakes as to size and distance from the Tsunami Seismic System. Each microprocessor type Tsunami Tide and Tsunami Seismic System will be operated over the GOES SMS Satellite Network. The major equipment objective is to develop low-cost, reliable new instrumentation for use in a proposed Tsunami Warning Network.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0029, ION MEASUREMENTS IN THE LOWER D-REGION

R.O. OLSEN, U.S. Army, Atmospheric Sciences Lab., *Las Cruces, New Mexico* 88002 (DA0F1790)

The technical objective is to accomplish the following tasks: (a) flight of appropriate rocket-borne and balloon-borne instruments into the very low D-region (40-50 km) in order to acquire in situ data concerning ion masses (including cluster ions), ion mobilities, and related upper atmospheric data of importance to ELF/VLF propagation, and (b) evaluation of data obtained on these flights against theoretical and laboratory measurements so that the data can subsequently be employed to evaluate and improve existing ELF/VLF models employed in applicable predictive computer codes.

A balloon-borne positive ion/negative ion mass spectrometer payload will be flown to obtain mass-identified ion measurements. The rocket-borne probes will consist of Gerdien condensors to measure ion mobility and blunt probes to measure ion conductivity.

SUPPORTED BY U.S. Dept. of Defense, Electronics Research & Development Command, Atmospheric Sciences Lab.

5.0030, NAVY ENVIRONMENT - ATMOSPHERIC ION COMPLEXES

V. MOHNEN, State University of New York, School of Arts & Sciences, *Albany, New York* 12222 (DN923067; N00014-75-C-0283)

The objective of this research is, at a rather fundamental level, to identify the ion-molecular complexes in the atmosphere that act as charge carriers and which also evolve into larger complexes to become condensation nuclei for cloud and fog formation. The variability in the number and kind of these complexes may hold the explanation of why fog sometimes fails to form even though by coincidence of the temperature and dewpoint the air appears to be saturated. If such a correlation exists, the forecasting of fog in support of military operations can be improved.

Using an ion drift tube, a plasma chromatograph, into which air-like gas mixtures will be introduced, the nature of atmospheric ions (charge carriers) will be examined and assessed for their role in air chemistry. Based on this experimental work and available field data, an effort will be made to model the important chemical and physical transformation reactions governing the chemical composition of aerosols and clouds.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0031, ATMOSPHERIC ELECTRICITY

B. VONNEGUT, State University of New York, School of Arts & Sciences, *Albany, New York* 12222 (ATM76-00908 A02)

The scientific objectives of this project are more specific than previously mentioned (see Form 4 of ATM-7600908), but fall within the same four topics.

They are: (1) Initiation cirriform clouds by seeding ice supersaturated air with silver iodide. (2) Study of rainfall structures with various synoptic conditions. (3) Interpretation of satellite data for lightning detection. (4) Quantitiative information concerning the extraordinary electrical activity during tornado events.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0032, INTERPRETABILITY FOR FORESTRY PURPOSES OF OPTICALLY ENHANCED MULTISPECTRAL AIR PHOTOGRAPHY IN NORTH

J.O. LAMMI, Univ. of North Carolina, School of For. Resources, *Raleigh, North Carolina* 27607 (0073462; NC04059)

OBJECTIVE: Evaluate utility of multispectral (MS) aerial photography now available for various NC test sites, compare MS with conventional stereo photography at selected test sites for forestry needs.

APPROACH: Selected frames of MS photography will be studied with and without optical enhancement by SDC 66 color additive viewer. Comparisons will be made with conventional stereo photos and ground studies to evaluate advantages and disadvantages.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, North Carolina

5.0033, LIDAR ATMOSPHERIC MEASUREMENT PROGRAM INDEX

K.T. PETRI, U.S. Navy, Air Development Center, *Warminster, Pennsylvania* 18974 (DN681244)

To investigate the feasibility of utilizing a lidar to remotely measure atmospheric properties which impact the performance of radio/optical frequency systems.

Lidar techniques will be tested and evaluated to determine the optimum method of remotely measuring the radio refractive index and electrooptical properties of the atmosphere. Measurement precision will be equal to or greater than that of existing radiosonde methods. Some work is also planned on contracts as reported in work unit RG702 B, B1 and RG704 B.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

5.0034, MESOSCALE WEATHER SYSTEMS IN THE TEXAS COASTAL ZONE

K.H. JEHN, Univ. of Texas, School of Engineering, *Austin, Texas* 78712

DESCRIPTION: The central problem of weather forecasting is the handling of the mesoscale weather producers (severe thunderstorms and flash floods, for example). This is especially true since the synoptic-scale motion field prognosis is so well handled currently by numerical models out to 48 hours. Part of the problem is in the synoptic-to-mesoscale links, some of which are handled by model output statistics (MOS), and part is in the need for more detailed knowledge of mesoscale weather system characteristics.

The Texas coastal zone experiences a variety of mesoscale weather systems of varying intensity, and the existing synoptic-scale weather network is inadequate to 'catch' these migratory weather systems. Weather radar and weather satellites create opportunities for monitoring these systems operationally. What is needed are studies of the characteristics of these weather systems, utilizing radar and satellite data as well as existing standard meteorological reports. Additionally, a network of mesoscale observing stations will need to be established in part of the coastal zone as part of the 'ground truth' data in support of radar and satellite observations, and to provide additional detail in such meteorological variables as temperature, humidity, pressure, and wind.

A proposal for such a major mesoscale investigation is now being prepared for submission to the Army Research Office, whose interest in basic research on smaller scale meteorological phenomena is well known.

Considerable practical benefit to coastal zone residents should accrue from this research project, which would continue for several years if funded.

SUPPORTED BY University of Texas

5.0035, PHENOLOGY, WEATHER AND CROP YIELDS
J.C. HARLON, Texas A & M University System, Remote Sensing Center, *College Station, Texas* 77843 (0071900; TEX02956)

OBJECTIVE: Analyze and interpret remotely sensed data to: Understand yield dynamics and, improve prediction of yield of selected agricultural crops.

APPROACH: Remotely sensed data from aircraft and satellites will be obtained from NASA and USDI. The data will be processed for selected sites using techniques developed and used for NE-69. Transformed parameters developed from the processed data will be correlated to crop condition, yield, phenophase and acreage through statistical regression techniques.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Texas

5.0036, NAVY ENVIRONMENT - STRATOSPHERIC E-PROBE
H.J. CHRISTIAN, Rice University, Graduate School, *Houston, Texas* 77001 (DN775172; N00014-77-C-0154)

In order to gain further insight into the electric coupling between the upper and lower atmosphere, prepare a conductivity meter, a current-sensing element and a stratospheric E-field sensing system for making field measurements in the arctic stratosphere.

Using an enlarged super-pressure arctic balloon electric field sensor (ABEFS), conduct an experiment in the arctic to measure stratospheric electrical parameters attempting to differentiate between stratospheric and fine weather ground-based electrical properties. Insofar as practical, define the magnetospheric influence on stratospheric measured fields and develop theory concerning solar-terrestrial effects on the earth's weather system and the electric coupling between ionosphere and troposphere.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences, Man/system Technology and Life Support; and Planetary Biology.

6.0001, SIMULATOR TECHNIQUES FOR VALIDATING TASK ANALYSES
J.A. REED, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF223690)

To develop a methodology for validating a task analysis to include cue assessment, simulator fidelity, and determination of tasks partially or wholly trainable in a simulator.

The task analyses will be compared to prerecorded tapes of selected basic fighter maneuvers (BFM) in the SAAC. This comparison will verify critical elements of each maneuver. The fidelity of the visual and motion cues provided by the simulator in terms of their similarity to cues experienced in actual flight will also be verified. Also, all common elements of each task will be verified for sequencing of instruction. Data points for objective and subjective grading will also be verified.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0002, INSTRUCTIONAL FEATURES
J.C. REED, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF223830)

To study a variety of existing or future systems found on the simulator for air-to-air combat (SAAC) from a behavioral perspective in order to recommend utilization of various instructional features in advanced simulation.

A variety of approaches will be utilized, dependent on the specific feature investigated. Subjective and objective measures will be employed as well as closely monitored engineering support data. A transfer of training to the aircraft paradigm will be employed as resources permit.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0003, PHYSICAL CONDITIONING FACTORS BASIC TO IMPROVED PHYSIOLOGICAL RESPONSES DURING MUSCULAR EFFORT
E.M. BERNAUER, Univ. of California, School of Letters & Science, *Davis, California* 95616 (DF050480; AF-AFOSR-3510-78)

AF function - Air Force operations expose personnel to a wide range of environmental stresses. With the introduction of high-performance aircraft into the tactical arena, high sustained g forces pose serious limitations on the crew member's ability to function at levels that may approach or exceed physiological tolerances. Deficiency - methodology is needed to predict and quantify physiological performance under a combination of operational stresses encountered by Air Force crew members. Objective - this research should provide data for validating conditioning regimens leading to satisfactory levels of tolerance and to screening and predictive models for use in selecting and monitoring personnel. How research contributes - the research supports USAFSAM and AMRL studies dealing with protective equipment and setting design criteria for crew habitability and selection, and is identified under 1.5, 1.6, and 1.7.

This effort will seek to re-examine the role of exercise conditioning as a means of improving tolerance to high sustained g. Measured differences in physiological responses between men and women to standardized stress tests of either exercise or orthostatic tolerance will be made. An attempt will be made to identify the physiological variables underlying gz tolerance, and the extent to which these can be modified to enhance tolerance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0004, MODELLING ROLL SIMULATOR WASHOUT
H. JEX, Systems Technology Inc., *Hawthorne, California* 90250 (DF320760; F33615-77-C-0508)

Considering the increased use of moving base simulators in the Air Force the requirement for better simulator design criteria based upon human operator technology is timely, but more research is needed in this area. A continuing effort to develop this type of simulation criteria technology is being pursued by AMRL (EM). A significant portion of moving base simulator design is the use of washout circuits to limit simulator motion. A criterion that can be linked to pilot performance is desirable. The objective of this research effort is to formulate an experiment that can accomplish this in the roll axis, perform the experiment, collect data and analyze the data. From the results, optimum washout design criteria and human operator models for the roll axis will be formulated. The results of this effort are needed by AFHRL, AFFDL, and AMRL for improved design of motion base simulators.

To have Systems Technology, Inc., assist AMRL/EM in the performance of experiments and model development and validation related to the effects of roll simulator 'washout' upon pilot behavior, performance, and subjective evaluations of realism and interference with control behavior. The intended effort can be divided into six phases Phase 1, state-of-the-art critique, Phase 2, washout selection, Phase 3, experimental planning and liaison, Phase 4, data analysis, Phase 5, data interpretation and validation, and Phase 6, documentation. This work is being transferred from work unit 68930225.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0005, THE HERITAGE OF AVIATION MEDICINE
R.J. BENFORD, Aerospace Medical Association, *Washington, District of Columbia* 20001 (R01 LM 02656-02)

OBJECTIVES. This project proposes the preparation of a manuscript for a catalog/directory affording direct access to the

identification and location of significant aviation medical memorabilia, artifacts and relics now preserved in museums, archives, libraries and private collections. Published material, except for rare items, would be excluded. There is no known similar reference work.

METHODS: Queries of solicitation for information desired would be directed to selected curators, archivists and librarians, to historians of medical and aviation societies, and to private collectors. Additional input may follow (1) a suggested announcement in newsletters, bulletins and other publications of these organizations, and (2) wide distribution of a news release, possibly by the Aerospace Medical Association, to the medical and aviation press. The aim is to uncover material held by individuals (often their own equipment or keepsakes) so that through correspondence additional items might be identified--like a chain letter. Because printed catalogs of museums are rarely available, visits will be made to the largest aviation medical and aerospace collections and exhibits. Searches for foreign material, probably limited to Canada, England, France, and Germany, would be initiated by queries to the senior Air Force Medical Officer, airline Medical Director, and civil Air Surgeon of each country. A system of filing and indexing data will permit continuous compilation of information up to an established deadline. The planned manuscript, organized by subjects, will include, for specific material, appropriate description, historical comment, essential illustrations, ownership credit, and availability for loan.

SUPPORTED BY U.S. Dept. of Health Education & Welfare, National Inst. of Health, National Library of Medicine

6.0006, DYNAMICS OF AIRCRAFT ACCIDENT VICTIMS - COMPUTER SIMULATION

J.M. BALLO, U.S. Dept. of Defense, Armed Forces Inst. of Path., *Washington, District of Columbia* 20306 (DA OB 6608)

Computer simulation of the kinematics of occupants in selected aircraft accidents in order to recreate the sequence of injuries and to determine their specific cause(s). This will lead to an increased understanding of the pathogenesis of such injuries and lead to more effective means of preventing them. Examine feasibility of running concurrently the KRASH vehicle impact simulation code so as to enhance the realism of occupant-vehicle interaction.

Operate the CALSPAN three-dimensional program as a model using selected Aerospace Pathology Division cases as sources of input data. Correlate the actual injuries observed at autopsy with the injuries predicted from the occupant kinematics of the computer simulation. Use the optimal output features of the CALSPAN code, using subroutines to calculate injury severity indices and time points of maximum injury.

Five additional cases of accidents involving UH1H helicopters have been successfully simulated. The range of decelerative pulses at impact has been extended to include inverted attitudes. Simulations have also been run involving ground impact of individuals involved with out-of-envelope ejection system failures. The body of the report amplifies these considerations.

SUPPORTED BY U.S. Dept. of Defense, Armed Forces Inst. of Pathology

6.0007, NAVY ISD PROGRAM SUPPORT

W.W. PROPHET, Human Resources Research Org., *Pensacola, Florida* 32505 (DN794003; N61339-77-C-0009)

This project is related to a current NavTraEquipCen 6.2 ISD program to establish the management and technical procedures for implementation of ISD in aviation training programs. This particular effort will provide a comparative analysis of the ongoing NTEC ISD program involving simultaneous application of ISD methodology to four different aircraft systems.

The procurement documents, procedures, and products of the ongoing ISD program will be examined to determine the extent to which these materials and techniques are sufficient for implementation. This comparative analysis will yield recommendations concerning synthesizing and standardizing ISD requirements, formats, specifications, and DID's.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Training Equipment Center

6.0008, IMPROVED PRODUCTIVITY THROUGH USE OF INTRINSIC REWARDS

R.D. PRITCHARD, Purdue University, Purdue Research Foundation, *Lafayette, Indiana* 47907 (DF232950; F33615-77-C-0026)

To develop operationally feasible techniques for enhancing airmen productivity. These techniques will concentrate on increasing the job incumbent's motivation to perform through intrinsic motivation procedures applied at the level of the first-line supervisor. The end product of this work unit will be a comprehensive plan for a field test of the techniques developed.

The most critical determinants of intrinsic motivation which have potential for application in an Air Force operational environment will be identified. A test of the significance of these determinants will be conducted in a laboratory setting test using objective performance and job attitude criteria. Results of the laboratory test will be used to develop a detailed research plan for an Air Force operational environment field test of techniques for enhancing airmen productivity. Milestones for this work unit are as follows: 1 Oct-31 Oct 76--identify determinants of intrinsic motivation to be controlled or manipulated in the laboratory experimental tests; 1 Nov-31 Jan 77--design the actual experiments to test variables selected in step 1; 1 Feb 77-31 Jul 77--develop necessary work sample materials and conduct experiments; 1 Aug-30 Sep 77--develop a field-test plan to improve airmen productivity in an operational Air Force setting; 1 Oct 77-31 Dec 77--finalize technical reports.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0009, VISUAL DISPLAY INTEGRATION FOR ADVANCED FIGHTER AIRCRAFT

G. MILLS, McDonnell Douglas Astro. Co., *St. Louis, Missouri* 63166 (DF323660; F33615-77-C-0536)

To provide a systematic definition and assessment of optical visual display design approaches for future tactical fighter aircraft employing advanced technology. During FY 77 this contract will begin (1) a planning and technical framework for a phased, multi-year development and evaluation of cockpit design alternatives, and (2) a series of engineering trade-off comparisons among alternative approaches for visual display integration. This effort is needed because cost reductions dictate smaller-size vehicles which results in reduced panel space for cockpit control display, as typified by the F-16; at the same time technology provides an overwhelming amount of flight data and new flight modes previously unavailable with inadequate means of integrating the new technologies and determining impact on the crew. The proposed work will aid in closing the gap in display integration technology in a near-term applied context emphasizing advanced avionic and flight vehicle state of the art.

This is the second of three contract efforts (triple award) aimed at developing better methods and criteria for interfacing tactical aircrews within advanced technology fighter aircraft (i.e., operational capability post-1985). Visual display design alternatives will be derived based upon mission requirements analyses, crew size/function options, and potential (aircraft, avionic, and display system) technology combinations. Engineering trade-off comparisons among the postulated alternatives will determine the incremental impact of specific applications of advnaced display technology upon aircrew needs, capabilities and cockpit configurations. Figures of merit used in the trade-off analysis will include performance, safety, survivability and cost. Promising alternative designs may be selected for detailed development and evaluation under a follow-on contract.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0010, MECHANICS OF HYPEREXTENSION INJURY IN THE THORACIC SPINE

L.E. KAZARIAN, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF324200)

To identify the biomechanical conditions responsible for hyperextension injuries of the thoracic spine in the chimpanzee. This will examine the role of the powered 'haul back' system on shoulder and thoracic chest dynamics. These data will provide some insight into the mode and severity of spinal injury, shoulder

and rib cage dynamics with respect to normal kinematics, and define the relationships between haulback angle and shoulder position to minimize upper thoracic chest injury potential. The information from this study will be used to develop new design criteria and protective measures for modifying current operational support and restraint systems and to provide design limits for future aerospace ejection systems.

Chimpanzees will be anesthetized, placed within current and modified support and restraint systems, and hauled back by powered retraction. High-speed motion pictures will be taken simultaneously with the retraction. Acute and chronic injury modes will be identified later. The biomechanical parameters relating to spinal and thoracic chest trauma will be correlated to sitting height, shoulder height, retraction angle, shoulder kinetics, and pathology. The biomechanical factors responsible for perpetrating injuries will be delineated. These data will be utilized to develop a three-dimensional geometric and material property and kinesiologic model of the upper thoracic chest dynamics with respect to the angle of powered retraction for the chimpanzee.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0011, PERSONNEL TECHNOLOGY - COGNITIVE-FACTORS ANALYSIS OF SKILLED HUMAN PERFORMANCE
S.W. KEELE, Oregon State Higher Educ. Sys., School of Liberal Arts, *Eugene, Oregon* 97401 (DN775694; N00014-77-C-0643)

This work will explore a cognitive-factors approach to analysis and prediction of skilled performance under high information loads. Examples of relevant situations are military piloting, air and sea traffic control, and fire control. Competent performance of these sorts of tasks is dependent on at least five discernable cognitive abilities: (1) dynamic verbal and spatial memory; (2) perceptual extrapolation; (3) time-sharing; (4) cognitive flexibility; and (5) redundancy apperception. This work has three major objectives: (1) determination of the construct validity of the above-mentioned components of skilled performance; (2) assessment of the concurrent validity of measures of these components as predictors of on-the-job performance; and (3) assessment of the predictive validity of the measures.

The objective of establishing construct validity will be accomplished through the formulation and empirical assessment (via factor analysis) of a battery of information-processing tasks designed to tap the proposed cognitive components. Concurrent validity will be established by administering the refined battery to skilled pilots and performers of other relevant tasks. Performance on the battery will be correlated with appropriate measures of on-the-job performance. Predictive validity will be established by administering the test battery to flying student pilots and establishing the relationship of their performance to subsequent success in training.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

6.0012, TEST OF VARIABLE G-VALVE
R.R. BURTON, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF323440)

To test and evaluate experimental anti-g valves at the Naval Air Development Center (NADC).

Experimental anti-g valves developed at the School of Aerospace Medicine (SAM) will be tested and evaluated at NADC using SAM subjects and TAC fighter pilots. The NADC centrifuge will be used to expose these persons to rapid g onset rates (6 g/sec). Subjective and objective data will be obtained relative to the inflation rate of the anti-g suit.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0013, AFISC CIVILIAN GROUND-SAFETY OFFICER JOB INVENTORY
D.K. COWAN, U.S. Air Force, Human Resources Laboratory, *San Antonio, Texas* 78235 (DF233170)

To develop a ground-safety officer job inventory for use by the Air Force Inspection and Safety Center (AFISC) in establishing or revising ground-safety education programs.

The ground-safety officer job inventory will be administered by AFISC to approximately 400 civilian ground-safety officers. Punched data will be furnished to AFHRL for computer operations and limited analysis of data. Milestones - May 77 administration of inventory, July 77 keypunching, Sep 77 CODAP analysis, Dec 77 administrative report.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0014, ANALYSIS OF PAIRED AIR FORCE STRESS DATA CONTAINING ZEROS
A.J. RAHE, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF316740)

Analysis of Air Force studies for determining the tolerance levels of aircrew and support personnel to various operational stresses require statistical techniques to minimize the number of costly observations required and to maximize the assurance from the observations made. One such technique is Wilcoxon's signed-rank test, the performance of which is well documented for the case of no zeroes in the data. But stress data at this laboratory involve zero data. For this case Wilcoxon's test is not strictly appropriate; John W. Pratt has proposed a modification that would be logical but cannot be implemented or evaluated until further information is available. The objective of this effort is to develop the additional numeric information and investigate its properties so that the most efficient statistical method may be used in cases of Air Force stress data involving ranks with zeroes.

Critical values will be computed for the Pratt procedure, starting at sample size (n) of six, with the number of zeroes running in half the sample size (n/2), up to a maximum sample size such that the known Gaussian approximation published by Cureton is adequate for larger n. Enumeration will be used for the smaller n but the tremendous number of possibilities requires some analytic, iterative, or Monte Carlo approach beyond an n of ten or twelve. When critical values have been obtained, comparisons will be made with the unmodified Wilcoxon approach.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, DEVELOP A SOFTWARE MODULE WHICH REMOVES GEOMETRIC DISTORTIONS FROM AIRCRAFT MULTISPECTRAL CLASSIFIED DATA
A.T. JOYCE, U.S. Natl. Aero. & Space Adm., Earth Resources Laboratory, *Slidell, Louisiana* 70548 (D5-E771; V625C-16)

OBJECTIVE: Develop a technique of resampling the multispectral aircraft data so that most geometric distortions are removed and the data are registered to the U.T.M. grid. This technique is to be incorporated into a computer software module that can be adapted to the EPA/EMSL computer system.

TECHNICAL APPROACH: The software module will basically consist of two computer programs. The first program will accept as inputs ground control points and other parameters such as boundaries of the area to be resampled and cell size to be used. The outputs will be mapping coefficients which will be accepted by the second program which will actually do the resampling and output the geographically corrected data. The mapping coefficients, which are based on control points, will be used to determine scan lines and element numbers as functions of eastings and northings. The type and number of coefficients to be used will be determined by the relative stability of the aircraft platform for the particular flight.

PROGRESS: Test aircraft data sets acquired and software development has begun; 06/78 Final Report.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Energy Minerals & Industry

7.0002, OPERATIONS LOADS SURVEY DATA MANAGEMENT

A.L. EUBANKS, Bell Helicopter Company, *Fort Worth, Texas* 76101 (DA0E3781; DAAJ02-77-C-0053)

Provide access to the AH-1G Operational Loads Survey (OLS) data tape library (175 magnetic tapes containing digital flight test data from the aerodynamic and structural loads survey of a helicopter during operational maneuvers) allowing the user to select the data to be retrieved, specify certain processes by which the data may be reduced and/or analyzed and choose the mode by which the data will be presented.

Develop a computer software system that will process the AH-1G OLS data. The software system must accept data formated as the existing OLS digitized data tapes and be provided with output options capable of producing listings, plots and interactive graphical displays on CRT.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, EXPERIMENTAL STUDIES OF QUASI-ONE-DIMENSIONAL CRYSTALS

P.M. CHAIKIN, Univ. of California, School of Letters & Science, *Los Angeles, California* 90024 (DMR76-83421 A01)

A primarily experimental study of the transport properties of quasi-one-dimensional compounds as exemplified by the TCNQ salts is being continued. Measurements of the thermoelectric power of these salts give direct information about the interactions which produce their unusual properties. In particular, this group has: (1) shown the importance of, and measured the Coulomb correlation in several TCNQ compounds, (2) measured the amount of cation-anion charge transfer, (3) given an understanding of the band structures, (4) allowed us to associate the conductivity with certain chains, (5) associated these chains with certain transitions (in TTF-TCNQ) and (6) shown the effect of disorder on the metal-insulator transitions and low-temperature state.

The thermopower of several new organic compounds, especially those which are potentially metallic at low temperature, is being measured. In addition transport measurements (including thermopower) in a magnetic field are being performed to gain more information about correlation effects and Peierls transitions. Finally, 'transverse thermopower' (electric field perpendicular to temperature gradient) and transport in films of these compounds are to be investigated.

This is a continuation of work supported by DMR73-07518. This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0002, LOW- AND MEDIUM-ENERGY NUCLEAR PHYSICS RESEARCH

M.B. GREENFIELD, State University of Fla. Sys., School of Science & Technology, *Tallahassee, Florida* 32307 (PHY77-03313 A01)

Florida A & M University will participate in low- and medium-energy nuclear physics research at the Los Alamos Meson Physics Facility (LAMPF) and the Indiana University Cyclotron Facility (IUCF). The following projects will be continued or initiated: (1) Mechanisms of (pion, pion n) Reactions on Complex Targets (LAMPF); (2) A Survey of Quasi-Elastic Pion Scattering (LAMPF); (3) Comparison of the Quasi-Elastic Ratio sigma (negative pion, negative pion n)/sigma (positive pion, positive pion n) to the Ratio sigma(positive pion, positive pion p)/sigma (negative pion, negative pion p) in a Coincidence Experiment (LAMPF), (4) Set-Up of Beam Rotating System for Time-of-Flight Experiments (IUCF), and (5) A Study of the Isospin Makeup of Giant Resonances (IUCF).

This work will be performed in collaboration with user groups from a number of other institutions, including Oregon State University, University of Oregon, Virginia Polytechnic Institute, University of Texas, Oak Ridge National Laboratory and Kent State University.

This work is a continuation of that performed under Foundation grant PHY77-03313.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0003, CRYSTAL-FIELD EFFECTS IN MAGNETIC SYSTEMS

Y. WANG, State University of Fla. Sys., School of Arts & Sciences, *Tallahassee, Florida* 32306 (DMR77-21539)

The advancement in experimental techniques in recent years have made the detailed measurement of crystal-field effects in a magnetic system possible which in turn demands a refined theoretical treatment. The development of accurate theoretical methods in treating magnetic systems where the crystal-field plays an essential role will be carried out. Examples of the physical systems are the rare earth compounds, especially the induced moment systems with singlet or nonmagnetic doublet ground states. Two methods will be used to study the crystal-field effects in these compounds. A Green's function theory which incorporates the correlations of fluctuations in a systematic procedure will be applied to the induced moment systems. The theory is expected to explain the line broadening in neutron scattering experiments, the behavior of the central mode, and the thermodynamic quantities such as magnetization, susceptibility, specific heat, and the critical temperature.

This is a continuation of research supported under DMR7302318.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0004, AN EPR-ENDOR STUDY OF EXOELECTRON EMISSION TRAPS IN CERAMIC AND SINGLE CRYSTALLINE BERYLLIUM OXIDE

A.K. GARRISON, Emory University, Graduate School, *Atlanta, Georgia* 30322 (DMR77-00314 A01)

Continuation of research supported under DMR75-03281.

Electron nuclear double resonance (ENDOR) will be used to characterize the traps involved in exoelectron emission (EE) in the crystalline and ceramic forms of BeO which have been previously exposed to ionizing radiation. Since thermally stimulated EE (TSEE) is the basis for a sensitive radiation dosimeter made from ceramic BeO, the aim of the study is not only to increase the understanding of the basic EE processes but also to aid in the development of a more reliable TSEE detector.

Initial ENDOR studies done by the co-principal investigators have shown that lithium is present in the BeO ceramic dosimeter material at levels at least two orders of magnitude above that previously known. It serves as a charge trap and may be the primary trap in the exoelectron and luminescence processes. Once all the paramagnetic traps are characterized by ENDOR, it is proposed to use the ENDOR signals as unique microscopic probes into the role of these traps in the EE processes. This will be done by combining ENDOR measurements with TSEE and thermoluminescence (TL) readout, optical stimulation of the traps, various radiation and annealing treatments, electron paramagnetic resonance (EPR) kinetic studies and electric conductivity measurements.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0005, RESPONSE OF SOLIDS TO ELECTROMAGNETIC RADIATION

J.D. DOW, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (EY-76-C-02-1198)

Calculations of the surface structures of transition metal dichalcogenides have led to a novel method of analyzing low energy electron diffraction (LEED) data. A phenomenological theory of luminescence from the nitrogen trap in GaAs 1-xPx has

been developed, and a theory of the vibrational density of states in superionic conductors has been worked out. In progress are studies of the phases of exciton droplets.

SUPPORTED BY U.S. Dept. of Energy, Unspecified Unit

8.0006, PARITY NONCONSERVATION IN THE STRONG INTERACTION

H. FRAUENFELDER, Univ. of Illinois, School of Liberal Arts & Sci., *Urbana, Illinois* 61801 (PHY78-07751)

This proposal deals with the study of parity-violating effects in strong interactions. The helicity dependence of nucleon-nucleon scattering is searched for using the polarized beams available at the 15 MeV Los Alamos Van de Graaff accelerator, the 800 MeV Clinton P. Anderson Meson Physics Facility (LAMPF) and the 6 GeV accelerator at the Argonne National Laboratory in collaboration with groups from LAMPF and the University of Chicago. Parity violations in nucleon-nucleon scattering is expected to arise because of the existence of the weak force acting between nucleons and therefore extremely sensitive experiments have been designed to detect effects as small as 2-3 parts in 10 to the 8th power. The results of these experiments are expected to provide fundamental information on the nature of the weak interactions of nucleons.

This is a continuation of work supported under Foundation grant PHY77-03311.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0007, LIGHT SCATTERING STUDIES IN SEMICONDUCTORS AND DISORDERED SOLIDS

M.V. KLEIN, Univ. of Illinois, School of Liberal Arts & Sci., *Urbana, Illinois* 61801 (DMR77-04382 A01)

Research studies of electronic Raman scattering by electrons in semiconductor and disordered solids previously supported by NSF grant DMR-7307564 will be continued. A sum-rule for valley-orbit Raman scattering which can provide information about electron delocalization near the metal-insulator (M-I) transition in n-type silicon will be applied to an analysis of experimental data for phosphorus-doped silicon using a more sensitive detector. The valley-orbit donor Raman line will be studied under uniaxial stress as a function of concentration near the M-I transition, and the sum-rule will be generalized to cover stresses. The technique of resonant surface Raman scattering using visible lasers will be applied to electronic Raman scattering in semiconductors. Light scattering also will be used to study relaxation processes in solids including those processes that produce a dynamic central peak and couple to acoustical phonons. Examples include relaxation processes in glass, individual ionic hopping processes in fast ion conductors, and soft modes in ferroelectric crystals.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0008, HIGH-MAGNETIC-FIELD SUPERCONDUCTIVITY AND MAGNETISM IN TRANSITION METALS AND ALLOYS

R.R. HAKE, Indiana University, School of Arts & Sciences, *Bloomington, Indiana* 47401 (DMR77-10545 A01)

Research begun under NSF grant No. DMR7509940 will be continued and extended. A broad experimental program in the study of high magnetic field superconductivity in the transition-metal alloys will be undertaken and a major part of the program will involve the relationship between superconductivity and magnetism. Three areas of study are: 1) fluctuation effects and Type II superconductivity, 2) normal state electronic properties of disordered transition-metal alloys, and 3) spin glasses and Kondo systems.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0009, INTERACTING FERMI SYSTEMS

A.W. OVERHAUSER, Purdue University, School of Science, *Lafayette, Indiana* 47907 (DMR78-00545)

Research formerly supported by DMR74-03464.

Theoretical research will be carried out with the objective of a deeper understanding of electron-electron interactions in solids. Several types of phenomena will be investigated, such as one-electron energy spectra, collective phase transformations, collective excitations and dynamic scattering phenomena.

Also, some types of physical properties which have been found experimentally to exhibit anomalous behavior will be studied. These include the unusual magnetoresistance of sodium and potassium, the unexpected dependence with magnetic field of acoustic wave generation in aluminum and potassium and the thermal resistance of potassium at high magnetic fields.

First year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0010, KINETICS OF PHASE TRANSITIONS

H. SATO, Purdue University, School of Materials Engin., *Lafayette, Indiana* 47907 (PRF 8701)

The work concerns theoretical studies on typical irreversible phenomena in crystalline solids using a new, versatile method. The phenomena to be studied are those which are of specific interest in materials science like the kinetics of order-disorder transformation in alloys, the nature of glass transitions, the fast ionic transport in solid electrolytes and the re-examination of the foundation of kinetic processes. The method to be used is the Path Probability method of irreversible statistical mechanics. Although the irreversible statistical mechanics in general has made significant progess in recent years, theoretical descriptions of highly cooperative systems in crystalline solids have not yet been made in a satisfactory fashion. This research is aimed at filling this important gap and at giving satisfactory descriptions of the above-mentioned phenomena in terms of the newly devised Path Probability method with realistic degree of approximation.

A microscopic theory of kinetics of order-disorder transformation in binary alloys of body-centered cubic structure has been worked out. Especially the relaxation behavior of order parameters from states far from equilibrium has been clarified. The results provide with new, important information concerning the nature of glass transition. A statistical mechanical theory of cooperative, many body-diffusion processes is now being worked out.

SUPPORTED BY Purdue Research Foundation

8.0011, ELECTRONIC TUNNELING FROM METALS (QUASIPARTICLE INTERFERENCE)

W.J. TOMASCH, Univ. of Notre Dame, School of Science, *Notre Dame, Indiana* 46556 (DMR78-12994)

Electron tunneling experiments will be performed to examine the modification of the excitation spectrum due to perturbing the energy gap at one surface of a thick superconducting film. The tunneling measurements will be used to measure the quasiparticle velocities at the Fermi surface, to determine changes in the electron-phonon interaction that occur near the Fermi surface and to study the influence of proximity effect phenomena on the formation of energy levels. These measurements will be made on Zn, Cd, Tl and possibly Sn. Exploratory studies will be made of phonon-related structure in the tunneling characteristics of very thin binary films. These studies are important for the understanding of non-equilibrium superconductivity and the electronic devices based on this phenomenon. This is a continuation of work supported under DMR76-16998.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0012, HIGH-TEMPERATURE PLASMAS - INTENSE ION BEAMS

H.R. GRIEM, Univ. of Maryland, School of Arts & Sciences, *College Park, Maryland* 20742 (DN780195; N00014-75-C-0309)

Theoretical and numerical investigations are performed on the dynamics and stability of high-temperature plasmas and charged particle beams. Areas of particular concern are the generation and manipulation of intense relativistic electron beams, intense ion beams, laser-plasma interaction and plasma spectroscopy.

This program involves theoretical studies of (a) the equilibrium, stability and transport properties of intense ion beams and relativistic electron beams, (b) nonlinear effects, as they pertain to microstability behavior and anomalous transport in high-temperature plasmas, and (c) studies of radiation processes and atomic excitations by electron collisions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0013, THEORY OF PLASMAS WITH LARGE SELF FIELDS

J.U. GUILLORY, Univ. of Maryland, School of Arts & Sciences, *College Park, Maryland* 20742 (PHY77-25282)

Theoretical plasma physics studies initiated under NSF grant PHY76-80906 will be continued. Emphasis will be given to studies of the equilibrium and stability properties of magnetically-confined nonneutral plasmas which are characterized by intense self-electric fields and (in high-current configurations) intense self-magnetic fields. This includes basic studies of equilibrium and stability properties of (a) nonrelativistic nonneutral plasmas in uniform field geometries, (b) relativistic electron beam-plasma systems, (c) intense diamagnetic ion layers and rings, and (d) relativistic electron rings and E-layers.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0014, THEORETICAL STUDIES OF GRAVITY

C.W. MISNER, Univ. of Maryland, School of Arts & Sciences, *College Park, Maryland* 20742 (PHY76-20029 A01)

Research will deal with 1) the characterization of 'acceptable' naked singularities in the context of exploding black holes and topology change, 2) improved mathematical definitions of superspace, and 3) studies of properties of the Einstein equations which become interesting in view of current efforts to produce numerically computed solutions.

This work represents a continuation of that currently supported by Foundation grant PHY74-18386 AO1.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0015, COMPLETE CRYSTALLOGRAPHIC DEPENDENCE OF SURFACE REACTIONS BY CHEMILUMINESCENT IMAGING

R.L. PARK, Univ. of Maryland, School of Engineering, *College Park, Maryland* 20740 (DMR75-21379 A01)

The Principal Investigator continues his investigation of reactive luminescence as a non-interacting probe of surface reactions at technologically interesting temperatures and pressures. Although the quantum yield in surface reactions is extremely low, the reaction of ozone with magnesium has shown a strong dependence on the details of surface preparation. The present work, therefore, examines the role of crystallographic orientation on luminescence during the reaction of ozone with Al and Mg, in an effort to identify the mechanism of the luminescence. One hopes to be able to extend these studies to catalytic reactions. Such reactions can be sustained in order to obtain good spectral information, which, in turn, should provide insight into the reaction intermediates.

This is a continuation of research supported under DMR 75-21379.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0016, PARTICLE THEORY

R. ARNOWITT, Northeastern University, School of Liberal Arts, *Boston, Massachusetts* 02115 (PHY78-09613)

The proposed research is in the field of the theoretical physics with emphasis on attempting to understand the interactions of elementary particles. Specific projects will be pursued in the areas of: Local Supersymmetry - The co-principal investigators propose to continue their investigation of unified gauge theories based on local supersymmetry. Research would involve the following topics: 1. An investigation of the particle content of gauge supersymmetry. 2. Examination of whether the Bianchi identities of the theory lead to a consistent treatment of higher spins. 3. Examination of particle phenomenology in the 'low' energy region (2 less than or approximately 10 to the 8th power GeV) arising from gauge supersymmetry. 4. Discussion of quantum loop corrections. 5. Examination of the k yields O limit of gauge supersymmetry and its relation to supergravity. 6. Discussion of non-perturbative methods for calculation of quantum corrections. Quantum chromodynamics - 1. Dynamical examination of instanton-meron phenomena and quark confinement. 2. Investigation of non-perturbative approximation to QCD (such as Hartree-Fock) which satisfies the non-Abelian Ward identities.

This work is a continuation of that currently supported under NSF grant PHY 76-11455 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0017, ELECTRONIC CHARACTERISTICS III-V SURFACES

H. GATOS, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (DF902320; F19628-77-C-0060)

TECHNICAL OBJECTIVE: study of electronic structure of III-V surfaces in order to achieve surfaces of high stability, reliability and maintainability.

The investigation will study the surface state configuration of real surfaces, the surface recombination velocity and variations in composition resulting from chemical interactions with various ambients.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

8.0018, THE ELECTRON G-FACTOR ANOMALY AND RELATED EXPERIMENTS

A. RICH, Univ. of Michigan, School of Lit. Sci. & The Arts, *Ann Arbor, Michigan* 48104 (PHY77-26037)

This experiment uses the techniques of precise atomic metrology to measure a key fundamental property of an elementary particle (the electron) and its anti-particle (the positron). This is the measurement of the g-factor anomaly to an accuracy of 25 parts per billion. This will be a significant test of quantum electrodynamics and other fundamental physical theories. The method used is an extension of the Mott double-scattering technique. The anomaly is determined directly by observing the precision of the electron spin with respect to its velocity between the two scatterings. A number of improvements have been incorporated in the experiment.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0019, DOPPLER EFFECTS MEASUREMENTS

R.M. BRUGGER, Univ. of Missouri, Research Reactor Facility, *Columbia, Missouri* 65201 (ENG76-23104)

This project seeks accurate measurements of changes in capture cross sections as a function of material temperature. This is to be accomplished as a consequence of Doppler broadening of neutron capture resonances averaged over many resonances near a particular high energy. The measurements will be made using beams of 2 keV, 24 keV, 144 keV neutrons. These data will be used to refine the theoretical description of Doppler broadening and the Doppler coefficient. Emphasis of the research includes: (a) measurements of Doppler-induced changes in cross sections of materials passing through high-temperature phase transitions; (b) the observation of Doppler-induced changes in cross sections of only selected species of atoms, in an alloy or molecular crystal system, allowing identification of the chief contributors in situ, and (c) verification of Doppler models.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

8.0020, SURFACE ELECTROMAGNETIC WAVE STUDIES OF VARIOUS MATERIALS ON METAL SURFACES
R.J. BELL, Univ. of Missouri, School of Arts & Sciences, *Rolla, Missouri* 65401 (DMR75-19153 A01)

This is a continuation of research on the development of surface electromagnetic wave spectroscopy (SEWS) as a technique to study a variety of surface reactions. During this phase of the program, the following will be undertaken: (1) completion of assessment of SEWS as a surface science technique; (2) completion of studies on physisorption and chemisorption of benzene on clean, well-characterized Cu and Ni surfaces as a function of oxygen content; and (3) hydrogenation studies of benzene on Ni surfaces. This is a renewal of NSF grant DMR75-19153.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0021, FREE BOUNDARY PROBLEMS IN HYDRODYNAMICS
J.L. GAMMEL, St. Louis University, School of Arts & Sciences, *St. Louis, Missouri* 63103 (DF042240; AF-AFOSR-2935-76)

The modeling of the fireball resulting from an explosion is relevant to the analysis of nuclear weapons effects. Such modeling may be of use in the study of the interaction between explosions and its effect on aerospace vehicles and ground structures. These types of problems are of interest in the design of more effective aerospace and reentry vehicles. This proposal addresses the exact solution of the partial differential equations which arise in the model of the fireball by means of power series expansions. The problem of divergence of the power series for late times or in regions of space where the flow pattern is not smooth is solved by the use of Pade approximants or generalization of such approximations. The problem of concern is that of calculating the shape of the boundary and the height of the center of gravity at subsequent times. The research will also include the study of compressible bubbles, the effect of variation of the atmospheric density with height, and viscous flow. The study will also consider various types of turbulence on the boundary and its effect on mixing. Importance will be given to examining previously developed codes to answer convergence questions, the examination of the two Pade approximants which were applied to the fireball problem, and the application of the differential equation method through order t (to the 6th) to cylindrical bubbles.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NM, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

8.0022, INVESTIGATIONS IN PLASMA DYNAMICS
G. SCHMIDT, Stevens Institute of Technol., School of Engineering, *Hoboken, New Jersey* 07030 (EY-76-S-02-3004)

Analytical study of r.f. plasma heating in toroidal devices, nonlinear drift waves and drift waves in magnetic shear geometry. Computer generated analytical results on parametric instabilities arising in r.f. heating of plasmas.

RESULTS: The modification of the drift wave spectrum by lower hybrid heating waves was studied. It was shown that zero frequency drift modes are not unstable in Tokamaks. A dispersion relation for nonlinear scattering of drift waves has been derived. Progress has been made in automating the calculation of parametric processes analytically by computer.

SUPPORTED BY U.S. Dept. of Energy, Div. of Magnetic Fusion Energy

8.0023, NONLINEAR BEAM-PLASMA INTERACTION
M. SEIDL, Stevens Institute of Technol., School of Engineering, *Hoboken, New Jersey* 07030 (PHY77-07214 A02)

Interaction of strong electron beams (beam density larger than one percent of plasma density) with magnetoplasma will be studied experimentally. The ratio of the beam injection velocity to the thermal velocity of plasma electrons will be varied in wide margin (from 3 to 200). Nonlinear processes responsible for the interaction will be identified and their role in the development of plasma turbulence will be evaluated. The instabilities resulting from the coupling of collective and atomic processes will be studied.

This work is a continuation of that currently supported under NSF grant number PHY77-07214 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0024, SURVEILLANCE AND MATERIALS SUPPORT TECHNOLOGY - ELECTRONIC AND MAGNETIC PROPERTIES OF MATERIALS FOR CRYOGENIC DEVICES
P. LINDENFELD, Rutgers The State University, School of Arts & Sciences, *New Brunswick, New Jersey* 08903 (DN775011; N00014-76-C-1064)

The objectives of this task are to study the electronic and magnetic properties of superconducting and non-superconducting materials for use in surveillance and communications devices of interest to the Navy.

This task comprises a variety of experimental investigations in the areas of low-temperature physics, superconductivity, solid-state physics and cryogenics. They include: thermal measurements of granular aluminum films; non-linear electromagnetic response in superconductors; fluctuations in the diamagnetic susceptibility of superconductors containing magnetic impurities; hysteresis of the surface impedance in the mixed state of niobium; ultrasonic studies of magnetic materials and liquid crystals; magnetic resonance studies of the properties of semiconductors and metals and the interactions of ions and vortices in superfluid helium.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0025, BEAM-PLASMA INTERACTIONS IN TOROIDAL GEOMETRY
B.R. KUSSE, Cornell University, School of Engineering, *Ithaca, New York* 14850 (ENG77-03712 A01)

This research program consists of an experimental study of intense relativistic beam-plasma interactions in toroidal geometry. The purpose of the study is to determine if intense relativistic electron beams can be used to heat plasma confined in toroidal devices such as Stellarators and Tokamaks. Measurements will be made of the plasma heating which results from injecting an intense relativistic electron beam into the preionized Cornell Race Track. Preliminary injection and beam dynamics studies in this device have been completed. The characteristics of the beam and preionized plasma column are such that a strong beam-plasma interaction should be produced and significant heating of the plasma should occur.

This is a continuation of research previously supported under NSF grant ENG-7522556.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

8.0026, TRANSITION TEMPERATURE AND RELATED PROPERTIES OF SUPERCONDUCTORS
P.B. ALLEN, State University of New York, School of Arts & Sciences, *Stony Brook, New York* 11790 (DMR76-82946 A01)

Research under this grant will be an extension of work begun under NSF Grant DMR74-13593. The proposed program has two closely related parts: (1) a continuing study of the basic physics governing the superconducting transition temperature Tc; and (2) a study of the theory of electrical transport in d-band metals. State-of-the-art electronic band structures for d-band metals are to be used to extract coupling constants and many-body effects from transport and superconducting data and they are also to be used to attempt first-principle calculations of the superconducting coupling constants. Calculations of new many-body effects (not found in the free electron gas) will be undertaken and the consequence for superconductivity will be studied.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0027, FERROMAGNETIC RESONANCE IN COMPLEX MAGNETIC SYSTEMS

P.E. WIGEN, Ohio State University, School of Math. & Phys. Scis., *Columbus, Ohio* 43210 (DMR78-10300)

The magnetic properties of materials at solid surfaces and of thin films are often quite different from the properties in bulk samples. This is an active area of solid physics which may lead to new phenomena or new electronic structures. Ferromagnetic spinwave resonance will be used to investigate a variety of magnetic interactions in thin films of Yttrium Iron Garnet (YIG). Magnetic interactions of the YIG surface with magnetic metals will be investigated. In particular, recent theories predict that vanadium metal will have an antiferromagnetic surface layer, two or three atomic layers thick. The YIG surface is very sensitive to the onset of such interactions and will be used to study this effect. The exchange coefficient in magnetically diluted sublattices will be studied and compared with recent theories.

This research was previously supported under DMR-7614450.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0028, INVESTIGATION OF METHODS OF PLASMA EXCITATION

M. LAKE, Univ. Energy Systems Inc., *Dayton, Ohio* (DF461390; F33615-77-C-3113)

AF function - communication illumination weaponry. Deficiency -lack of data on efficient methods of plasma excitation and of microscopic excitation processes. Research - experimental analysis of excitation methods and cross sections. How research contributes -provides total ionization cross sections and excited state cross sections in both atomic and molecular gases. Microwave excitation provides efficient distributed discharge excitation.

The research will be conducted using three existing experimental configurations located in Bldg 450, WPAFB. They are a cross-beam excitation analyzer (2xb), a fast Fourier transform (FFT) facility and a microwave excitation facility.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

8.0029, MAGNETOOPTICAL PROPERTIES OF F CENTERS IN ALKALINE-EARTH OXIDES

T.M. WILSON, Okla. St. Univ., School of Arts & Sciences, *Stillwater, Oklahoma* 74075

Development of theoretical models and computer codes for calculating electronic and vibronic properties of defects and impurities in solids.

SUPPORTED BY Oklahoma State Government

8.0030, THE PHYSICS OF FLUIDS

R.J. DONNELLY, Oregon State Higher Educ. Sys., School of Liberal Arts, *Eugene, Oregon* 97401 (DMR78-10782)

This is a continuation of work sponsored under DMR-7621814.

Research on the hydrodynamics and thermodynamics of helium-II will be continued. Measurements will be made of quantum fluid turbulence to determine the mean and fluctuating parts of the vortex line density in a counterflow of normal and superfluid components. Equations of motion are being sought which contain all the realistic properties of the system, such as quantized vortices, healing and relaxation effects. A consistent data base for the thermodynamic properties of helium-II and mixtures of helium-3 and helium-4 will be generated. The results of this work are significant for the cooling of superconducting devices.

First year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0031, ELECTRON INITIATED ENERGY TRANSFER REACTIONS WITH ATOMS AND IONS

R.H. PRATT, Univ. of Pittsburgh, School of Arts & Sciences, *Pittsburgh, Pennsylvania* 15260 (PHY77-08199)

A research program in theoretical atomic physics will be initiated. Topics to be investigated include studies of several electron initiated energy transfer re ctions with atoms and ions, including inelastic electron scattering, radiative recombination, free-free bremsstrahlung and dielectronic recombination. These are processes of current and basic physical interest; the techniques used are of independent theoretical interest and more general applicability. The processes also have considerable practical import for the development of new energy sources and other questions of practical interest. This work is distinct from, although logically related to, Dr. Pratt's studies of quantum electrodynamics in external fields funded by the National Science Foundation. (Grant PHY 74-03531 A03)

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0032, RAMAN SCATTERING IN GROUP VB AMORPHOUS AND CRYSTALLINE SEMICONDUCTORS

J.S. LANNIN, Penn. State University, Graduate School, *University Park, Pennsylvania* 16802 (DMR76-81605)

Raman scattering measurements in amorphous arsenic, phosphorus and their related crystalline layer-like systems will be carried out. The study will provide basic information about the vibrational spectra of the amorphous materials, and the influence of preparation conditions on these properties. The crystalline counterparts with black P structure will be studied to obtain information about the long wavelength vibrational modes, the phonon density of states and their relation to the amorphous vibrational spectra. These results will provide a more detailed understanding of the structure and bonding of elemental group Vb solids.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0033, THEORETICAL STUDY OF ELECTRON-ELECTRON INTERACTIONS AMONG THE CONDUCTION ELECTRONS IN SOLIDS

J.J. QUINN, Brown University, Graduate School, *Providence, Rhode Island* 02912 (DMR78-08556)

Research previously supported by DMR7401454.

Theoretical research in solid-state physics will be carried out. Topics which will be investigated will include: (1) The electronic properties of semiconducting surface space charge layers. These systems exhibit intrinsically interesting phenomena and are of technological interest for the development of MOSFET devices. (2) The normal modes of a semi-infinite solid, such as surface phonons and plasmons. These have an effect on such experimental surface probes as Raman scattering and attenuated total reflection. (3) Electron-hole scattering in semimetals and semiconductors, which is an important mechanism for understanding the conductivity in these materials.

This is the first year of a 3-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0034, PHYSICS OF SOLIDS AND MACROMOLECULES

E.T. ARAKAWA, U.S. Dept. of Energy, Health Physics Division, *Oak Ridge, Tennessee* 37830 (000721)

Photons with energies from the IR to the soft x-ray region are used to obtain reflectance, transmittance, and photoelectron yield. Such data can be analyzed to yield the optical and dielectric functions associated with the bulk material, thin film effects, and interface properties such as surface roughness. In certain cases electron mean-free-paths and/or electron attenuation lengths can be obtained. Interpretation is in terms of energy levels in the solids and macromolecules and photon-electron, photon-plasmon, electron-electron and electron-phonon interactions in the systems. These basic observations have direct application to understanding, predicting, and possibly modifying the behavior of selected systems. Specific examples include the development of solar energy collectors, the prediction of the behavior of liquid lithium in a fusion reactor environment, and the measurement of electron mean-free-paths in communications materials. More generally it is desired to understand the basic interactions occur-

ring between normal cells in vivo and the subsequent effects of chemical and radiation assaults. Periodic publication of the results of basic research in the open literature.

SUPPORTED BY U.S. Dept. of Energy, Div. of Biomedical & Environmental Research

8.0035, CONFIGURATIONAL INSTABILITIES IN POINT DEFECTS IN CRYSTALS

T.L. ESTLE, Rice University, Graduate School, *Houston, Texas* 77001 (DMR76-07812 A01)

Research previously supported by DMR76-07812.

This research program is a coordinated experimental and theoretical study of defects in solids which are coupled to vibrational modes so that several equilibrium geometrical configurations with different orientations exist. The best-known of these is the Jahn-Teller effect but other types of vibronic and nonvibronic coupling lead to somewhat similar results. Electron paramagnetic resonance spectra for orbital-doublet impurity ions, orbital-triplet ions, and off-center impurity ions will be studied. These spectra will provide information about the distortions, evidence of dynamic behavior in quasi-static systems, and useful systematic data. The experimental results will be compared to theory. Calculations of adiabatic potential energy surfaces will be made. In addition, for some cases the resultant eigenvalue problem will be solved for the vibronic states.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0036, ENERGETICS OF ATOMIC AND MOLECULAR INTERACTIONS

G.K. WALTERS, Rice University, Graduate School, *Houston, Texas* 77001 (EY-76-S-05-4676)

This program emphasizes studies of structure and interactions of excited atoms, molecules, electrons and ions in both gases and liquids, as well as properties of and atomic interactions with solid surfaces. The program is oriented toward basic problems of relevance to the nation's energy program. Specific areas of current activity include studies of reactions and radiative lifetimes in atomic and molecular systems of high-efficiency laser promise (of interest for laser fusion, laser isotope separation), new approaches (both experimental and theoretical) to the study of solid surfaces; and ultimately heterogeneous catalysis, and understanding of spectra and collisional effects of general interest in plasma physics and controlled thermonuclear reaction technology.

The program involves 1) the use of electron (e-beam) bombardment and time-resolved spectroscopy in the study of transient excited species in dense gases of laser importance; 2) new approaches to the study of atomically clean crystalline surfaces, and their interaction with ambient gases; 3) development of tunable ultraviolet lasers; 4) theoretical studies of collision processes involving electrons, ions, atoms and molecules.

RESULTS: 1) Radiative lifetimes and reaction rates in dense rare gases and their mixtures (important to modeling and optimizing rare gas lasers); 2) demonstration of sizeable spin-polarization in low-energy electron diffraction from clean surfaces (important as new diagnostic for surface analysis, perhaps ultimately to heterogeneous catalysis); 3) advances in tunable dye laser technology; 4) new theoretical description of selected atomic and molecular collision processes and ion- and atom-surface interactions relevant to advanced energy research.

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0037, THEORETICAL STUDIES IN MANY-BODY PHYSICS

B. SUTHERLAND, Utah Higher Education System, School of Letters & Science, *Salt Lake City, Utah* 84112 (DMR77-08474)

Continuation of research supported by DMR72-05143.

The research will concentrate on two general theoretical topics of high current interest: 1) Soliton physics. This program will focus on the behavior of non-linear fields with symmetric and periodic interaction. The stability of the solutions will be examined and comparisons will be made with other mathematical models which exhibit phase transitions. 2) Exactly soluble models for quantum fluids. This program will deal with solutions of many-body models, such as the Hubbard model and the Wigner crystal. One of the objectives will be to test the validity of many-body approximation schemes on exactly soluble models.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0038, TOPICS IN THEORETICAL PHYSICS

C.E. CARLSON, Coll. of William & Mary, School of Arts & Sciences, *Williamsburg, Virginia* 23185 (PHY77-07409)

This work is a continuation of that supported by Foundation grant PHy75-15379 A01. The theoretical problems to be investigated concern models of hadronic production of particles with new quantum numbers, studies of relativistic bound state models for pions, calculation of bound states and resonances of the NN system near threshold, and problems associated with the extraction of neutron structure functions from deep inelastic e-d scattering.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0039, RADIATION PHYSICS

L.H. TOBUREN, U.S. Dept. of Energy, Battelle Pacific N.W. Lab., *Richland, Washington* 99352 (000740)

This program provides an integrated experimental and theoretical investigation of initial interactions by which ionizing particles transfer energy to matter and the subsequent transport and degradation of that energy. Measurements concentrate on determination of initial interaction cross sections for gas targets and on measurements of lifetimes of quenchable excited species in liquid systems. The work includes investigation of the partition and distributions of energy in the radiation field and in the irradiated media, and determination of the rates and mechanisms of energy transport in the early stages of molecular rearrangement. The results of this study provide the basic information on the initial interaction processes and formation of early chemical species along charged particle tracks. This information is basic to an understanding of the mechanisms underlying LET effects and dose response relationships. (1) August 1976 Publish analysis of differential cross sections for noble gas atoms based on criteria of Y.-K. Kim. (2) October 1976 Complete accumulation of data on proton ionization of H2O, H2 and O2. (3) January 1977 Initiate measurements of molecular fragmentation by fast protons. (4) April 1977 Complete study of energy dependence on ionization by carbon ions. (5) May 1977 Obtain preliminary results of Monte Carlo calculation of electron emission from fast proton ionization of carbon foils. (6) June 1978 Publish first study of molecular fragmentation by fast protons. (7) June 1976 Complete manuscript on temperature-dependence of energy transport around proton tracks in liquids. (8) September 1976 Complete measurements of LET dependence of fluorescence. (9) November 1977 Publish a stochastic model for fluorescence quenching in binary chemical systems. (10) December 1977 Initiate experiments to measure energy transport effects at less than 10 to the minus 10th power.

SUPPORTED BY U.S. Dept. of Energy, Div. of Biomedical & Environmental Research

8.0040, STRUCTURE OF PHYSICALLY ADSORBED LAYERS

S.C. FAIN, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (DMR77-26931)

Rare gas overlayers adsorbed on graphite are under investigation in a number of laboratories as model systems for the study of phase transitions and critical phenomena in quasi two-dimensional systems. Lower dimensional systems are important for testing theories of critical phenomena and cooperative phenomena in condensed matter. The structure of physically adsorbed monolayers and multilayers on solid-state surfaces will be studied by high-resolution, low-current, low-energy electron diffraction (LEED). The orientational epitaxy of out-of-registry Ar monolayers on graphite and the substrate-overlayer distance of

in-registry Kr monolayers on graphite will be studied. These results will permit direct tests of theoretical models of solid monolayers physically adsorbed on the basal plane of graphite single-crystals. An improved LEED-Auger apparatus for higher-resolution LEED and coverage measurements at lower temperatures will be built for use in these experimental studies.

This research was previously supported under DMR-7422168.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0041, THEORY OF ANISOTROPIC BEHAVIOR AND MAGNETOELASTIC INTERACTIONS IN RARE EARTH AND ACTINIDE MATERIALS

B.R. COOPER, West Va. University, School of Arts & Sciences, *Morgantown, West Virginia* 26506 (DMR77-06721)

Extremely anisotropic and unusual magnetic structures occur among cerium monopnictides and uranium and neptunium monopnictides or mixed monopnictide-monochalcogenides with NaCl-structure. These unusual magnetic structures are indicative of the presence for both the cerium and the light actinide compounds of a similar strongly anisotropic cooperative effect of a novel form. Investigations will be undertaken to understand what the effect is, how it gives rise to the magnetic structures and associated phenomena, and the fundamental origins of the effect. Through discussion of the possible analogue to the situation in UO2, magnetoelastic effects involving lattice internal rearrangement modes are introduced as the cause of the anisotropic effects of interest. Such a mode exists in the NaCl-structure. Besides providing a promising analogue for understanding the NaCl-structure material behavior, the presence of the lattice internal mode distortional transition in UO2 raises several interesting questions to be pursued for the behavior of that material. In a different manifestation of anisotropic interaction in rare-earth intermetallics, the excited state EPR g-anomaly in singlet-ground-state systems will be investigated.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, GAS DYNAMICS OF SEMI-DETACHED BINARY SYSTEMS

F.H. SHU, Univ. of California, School of Letters & Science, *Berkeley, California* 94720 (AST75-04809 A01)

Theoretical study includes systems as diverse as W Ursae Majoris stars, Algol variables, cataclysmic and binary X-ray sources of low total mass. These provide vivid examples that two stars placed in close proximity produce phenomena which are excitingly different from the sum of the individual behaviors of the separate stellar components. A unified approach is possible because the common thread which ties together the dynamics and the structure of these systems is the Roche model of close binary stars.

Using the Roche model, the study will include three theoretical problems: (a) the gas dynamics of mass transfer and mass loss in close binaries, (b) the properties of impact-driven accretion disks in semi-detached binaries, and (c) the structure and evolution of contact binaries. Self-consistent models will be constructed, and detailed comparisons with observations will be made.

Prior support was under AST 75-04809.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0002, HOT STARS WITH EXPANDING ATMOSPHERES

D.G. HUMMER, Univ. of Colorado, School of Arts & Sciences, *Boulder, Colorado* 80302 (AST77-23183)

Support is for studies concerned with the outer atmospheres and stellar winds of very hot and luminous stars, such as those of type Of, nuclei of planetary nebulae and Wolf-Rayet stars. Individual areas of research include stellar wind and line formation theory arising from stellar rotation, stellar wind models for absolute instability to investigate possible heating mechanisms for the wind, and the current discrepancies between theoretical and observational results on the temperature and ionization state of the wind. In the course of these investigations, excitation equilibrium calculations for He II, N III, C III-IV, and O VI will be carried out using a powerful multi-level, spherical geometry, expanding-atmosphere code that has been developed at the University of Colorado.

Prior support was by NSF Grant AST 76-22032.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0003, STUDIES IN STELLAR EVOLUTION

P.R. DEMARQUE, Yale University, Graduate School, *New Haven, Connecticut* 06520 (AST77-23188)

This research on stellar evolution will be concerned with theoretical problems of stellar interiors and the modelling of stellar populations in stellar systems. The emphasis of the work will be on three particular topics: 1) A program of construction of synthetic population models for stellar systems will be completed. 2) A study will be carried out of the effects on stellar evolution of variations in the carbon, nitrogen, and oxygen abundances. 3) There will be an investigation of the origin of the chemical inhomogeneities observed from star to star in old stellar systems, particularly within globular clusters. The emphasis will be on investigating effects of chemical mixing within the star.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0004, INFRARED AND OPTICAL PHOTOMETRY PROGRAMS AT LAS CAMPANAS OBSERVATORY

S.E. PERSSON, Carnegie Inst. of Washington, *Washington, District of Columbia* 20005 (AST76-22676 A01)

A photometric system suitable for use in the infrared spectral region will be completed for use on the 2.5 meter telescope at the Las Campanas Observatory in Chile. A general-purpose high-resolution spectrometer for use in the one to five micron region will be built.

Observational projects to be carried out using this photometric system include: 1) The extension of work on the stellar content of galaxies by means of recording and analyzing the distribution of energy as a function of wavelength in the red and infrared spectral regions. Particular attention will be paid to determining the fraction of heavy metals in stars. 2) Observations of southern hemisphere gaseous nebulae. Protostars will be located and their characteristics will be studied.

This research is a continuation of work previously supported under NSF grant AST 76-22676.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0005, SOLAR ACTIVITY INTERFERENCES WITH IONOSPHERE-DEPENDENT MILITARY SYSTEMS

R.W. KREPLIN, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN920016)

To develop techniques to predict and evaluate disturbances to ionosphere-dependent military systems, e.g., communications, navigation and surveillance. To further the understanding of the mechanisms of solar activity and to support objectives of the SOLRAD program.

Solar plasmas are studied to determine the physical mechanisms of solar activity. Observations are made with x-ray and gamma-ray spectrometers, x-ray cameras and scanning devices. The spectra of laser produced laboratory plasmas are also investigated to aid solar plasma investigations.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

10.0006, SOLAR-TERRESTRIAL PHYSICS
D.J. MICHELS, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN880036)

To improve basic understanding of the relationships between geophysical disturbances and the variability of solar plasma and electromagnetic radiations. Improved understanding of the mechanisms that cause disturbances in the earth's magnetic field and the ability to characterize and predict the occurrence and severity of such disturbances (geomagnetic storms) is of great importance to the Navy. Essential Navy/DOD systems are affected by geomagnetic anomalies; in some cases geomagnetic activity ranks high among causes of system outage or degradation or as a significant cause of false signatures.

Research emphasis will be on improved understanding of how the solar material is propagated towards earth and on understanding what parameters govern the severity of the geomagnetic response. Solar monitoring experiments will be flown in satellites; collaborative arrangements will be worked out to achieve the multidisciplinary approach required by this problem.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

10.0007, SOLAR FLARE AND SOLAR-INTERPLANETARY PHENOMENA INVESTIGATED WITH HIGH-ENERGY CHARGED PARTICLES
J.A. SIMPSON, Univ. of Chicago, Enrico Fermi Institute, *Chicago, Illinois* 60637 (ATM77-24494)

This grant will support the following: (1) A study of the physical conditions required for charged particle acceleration in solar flares (this problem will be attacked mainly by using the analysis of H and He isotopes and the relative abundances of key elements such as He, C, O, Si and Fe in the flux of flare particles). (2) A study of the dynamics and large scale magnetic configurations of the heliomagnetosphere arising from '11-year' changes in the solar magnetic field and plasmas (such as solar magnetic field polarity reversal) (analyzed by space experiments and neutron intensity monitors), (3) A study of the build-up and dissipation of corotating stream-stream interaction regions extending to approximately 15 astronomical units from the sun, and to determine their structure and related shocks. (These regions appear to play a significant role in solar modulation of cosmic rays near the ecliptic plane.)

The approach to this problem will be mainly by using data from Pioneer 10/11, space probes, neutron intensity monitor data and Jovian electron fluxes.

The overall aim is to study the energetic particle environment of the earth and the sun.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0008, INVESTIGATION OF A GROUP OF DENSE ROTATING INTERSTELLAR CLOUDS WHICH ARE UNDERGOING EXTENSIVE FRAGMENTATION
F.O. CLARK, Univ. of Kentucky, School of Arts & Sciences, *Lexington, Kentucky* 40506 (AST76-80200 A01)

In the Taurus region of the sky there is a group of interstellar gas clouds which are rotating, extensively fragmented, and probably in a state of gravitational collapse. These clouds will be studied by means of the microwave spectral lines of the common interstellar molecules formaldehyde, hydroxyl radical, and carbon monoxide. The study will determine the physical parameters of these clouds, such as kinetic temperature, density and density gradient, kinematics (rotation, fragmentation, and other measurable motions), and possibly also chemistry. The study will establish the details of rotation and fragmentation for this group of interstellar clouds, and demonstrate how the collapse motions are consistent with the conservation of angular momentum. The results will be useful for understanding how these processes actually take place and will provide an observational basis for theoretical calculations of realistic models which include rotation. The study is based on preliminary results which show unexpected detailed fragmentation taking place.

This is a continuation of work done under grant AST 76-80200.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0009, OPERATION OF CLARK LAKE RADIO OBSERVATORY
W.C. ERICKSON, Univ. of Maryland, School of Arts & Sciences, *College Park, Maryland* 20742 (AST77-12282 A01)

Continuation of support is for a two-year program of observations in the decametric wavelength range at the Clark Lake Radio Observatory in California and to complete the expansion of the present system into a multi-frequency radioheliograph.

Multi-frequency maps will be made at short intervals of the radio emission from plasma clouds as they move outward through the solar corona into interplanetary space. The maps in two polarizations will help to determine the magnetic field structure above flare regions and to understand energetic particle acceleration processes. Study will be undertaken of coronal holes and the transition region between the corona and the interplanetary medium. Also planetary radio emissions will be studied.

Radio sources outside the solar system will be observed to measure fluxes and spectra in these wavelengths. Attention will be given to variable sources, supernova remnants, and X-ray emitting objects, as well as the newly found sources so far observed only at decametric wavelengths.

The telescope system is electronically steerable and tunable between 10 and 125 megahertz. Hardware and software being added will develop it into a multi-frequency radioheliograph and aperture synthesis telescope.

Prior support was NSF grant AST 77-12282.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0010, RADIO CORONAL HOLES AND GEOMAGNETIC DISTURBANCES
M.D. PAPAGIANNIS, Boston University, Graduate School, *Boston, Massachusetts* 02215 (DF249650; F19628-77-C-0189)

AF function - communications and navigation. Deficiency - radio signal fading and changes in satellite orbit ephemerides. Objective -to determine the relationship between solar coronal hole radio parameters and the magnitude of terrestrial magnetic disturbances initiated by the high-speed wind streams from the holes. How research contributes -defines those radio coronal hole parameters that are operationally significant in forecasting the occurrence and severity of geomagnetic disturbances.

Archival radioheliograms obtained with moderate resolution radiotelescopes in the United States and Brazil at wavelengths from 21 cm to 0.12 cm will be examined and scaled for coronal hole data. Spectral characteristics of the radio coronal hole will be compared with solar wind and geomagnetic data to establish operational forecast parameters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

10.0011, TWO-DIMENSIONAL CLASSIFICATION OF STARS SOUTH OF 20 DEGREES IN THE HENRY DRAPER CATALOGUE
C.R. COWLEY, Univ. of Michigan, School of Lit. Sci. & The Arts, *Ann Arbor, Michigan* 48104 (AST77-27744)

This project will continue two-dimensional spectral classification of the southern stars of the Henry Draper catalogue. The spectra are on high-quality objective-prism plates taken with the Michigan Curtis Schmidt telescope located at the Cerro Tololo Inter-American Observatory in Chile. Volume 1, containing 36,000 stars between declinations of 90 degrees and minus 53 degrees was published in 1975, and Volume 2, containing 31,000 stars between declinations between minus 53 degrees and minus 40 degrees is now being prepared for publication.

During the two-year period of this grant it is expected that Volume 3 (containing classifications of about 32,000 stars) will be started. Also, the remaining plates for regions accessible rom Cerro Tololo will be obtained. In addition some combined statistical analyses of Volume 1 and 2 will be made, and lists of stars of special interest will be published.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0012, A STUDY OF NON-VARIABLE CEPHEID STRIP STARS

E.G. SCHMIDT, Univ. of Nebraska, School of Arts & Sciences, *Lincoln, Nebraska* 68508 (AST77-17520)

The Cepheid variable stars have proved to be valuable objects to use in comparisons of observational data with the predictions of the theories of stellar evolution and stellar pulsation. It has been claimed that there are stars which are not variable which are found in the same region of the Hertzsprung-Russell diagram as the Cepheid variables. This research will be concerned with observational studies aimed at identifying stellar clusters containing such nonvariable stars. Both the nonvariable stars and the early type cluster members will then be studied in order to determine what parameters control the appearance of nonvariables in the instability region of the Hertzsprung-Russell diagram.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0013, SMALL-SCALE MOTIONS IN THE ATMOSPHERE OF JUPITER

R.F. BEEBE, New Mexico State University, School of Arts & Sciences, *Las Cruces, New Mexico* 88001 (AST77-22962)

The extensive collection of photographs of Jupiter obtained since 1963 will be used for the measurement of small-scale motions of features in the zones and belts of the complex Jovian atmosphere. The photographs, in five spectral passbands from ultraviolet to near infrared, are made with the 24-inch, long focal length, planetary telescope at the university. The best images will be measured and reduced to obtain the planetary coordinates and dimensions of each feature as a function of time. Both long-lived and shorter duration features will be included in twenty latitudinal zones corresponding to the general flow patterns on the planet's surface. Analysis is made of the zonal and meridional components of the velocity from the longitudinal and latitudinal positions.

Accelerations and morphological changes will be analyzed with respect to both the optical and radio rotation rates in an attempt to improve understanding of the interaction between mass motion in the planetary core and atmosphere. Collaboration with atmospheric dynamicists will be promoted through direct mailing of measurements of Jovian features and of bulletins of interesting phenomena encountered in the measurements. All plates currently obtained and those of at least two previous years will be measured to extend the time base for long duration features.

Prior support was by NSF grant AST 75-03734 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0014, PREPARATION OF FINDING CHARTS FOR A CATALOG OF STARS WITH LARGE PROPER MOTIONS

H. ALBERS, Vassar College, Graduate School, *Poughkeepsie, New York* 12601 (AST77-14166 A01)

Stars of large proper motion are almost always relatively close to the sun. A few stars at greater distances may show large proper motions due to their unusually rapid motion through space. Both kinds are of interest in determining the stellar population of the solar neighborhood. The fainter objects are stars of low luminosity, including red main sequence, subdwarf, and white dwarf stars. These furnish information about the faint end of the luminosity function near the sun.

A catalog of stars over the whole sky with proper motions greater than 0.5 seconds of arc per year has been compiled by Willem Luyten at the University of Minnesota from his extensive researches and all published sources. The catalog contains positions, magnitudes, colors, and motions for all the stars known at present to fall within this limit. Support by this award will permit finding charts to be made so that they can be published together with the statistical data. It is planned to provide finding charts for all stars except those already in standard catalogs so that the published catalog will be of maximum value to the observational astronomer. The charts will be done by the principal investigator, Dr. Henry Albers, at the University of Minnesota, working in collaboration with Dr. Luyten.

Prior support was by NSF grant AST 77-14166.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0015, HIGH-ENERGY GAMMA RADIATION AT ONE MILLIBAR

G.M. FRYE, Case Western Reserve Univ., Graduate School, *Cleveland, Ohio* 44106 (AST77-27937)

Two high-altitude balloons will be flown in the summer of 1978 to make observations of cosmic gamma-ray sources in the Northern Hemisphere with a one square meter multiple wire proportional counter telescope. The instrument has a threshold energy of 7 MeV and is characterized at 100 MeV by an effective area of 980 sq.cm. an acceptance cone of 1.1 steradians, and an angular resolution of 3 degrees. On its initial flight in 1976, the telescope operated successfully and the data acquired are now being analyzed.

The 1978 flights will be made from the National Scientific Balloon Facility at Palestine, Texas, and will observe the region of the sky from 0 to 24 hours in right ascension and plus 5 degrees to plus 70 degrees in declination. Of primary importance are observations of the Cygnus and Anticenter regions of the galactic plane, the known radio frequency pulsars and the optically violently varying (OVV) quasars and BL Lac objects. Simultaneous optical and gamma-ray observations are planned of the OVV objects and of the Crab pulsar. The latter will permit a determination of the phase difference between the optical and gamma-ray pulses to within an accuracy of 0.1 msec. The observation of the Crab will be done with a telescope carried by a balloon which has a volume of 70.7 million cu. ft., the largest ever made. There will be a collaboration with Imperial College, the University of Southhampton, and the Space Science Department of the European Space Agency to build a drift chamber gamma-ray telescope which will have improved angular resolution for high-energy gamma-rays. This is a continuation of AST 76-02578 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0016, PREPARATION OF PROVISIONAL PHYSICAL EPHEMERIS FOR THE MAPPING OF MARS

R.L. DUNCOMBE, Univ. of Texas, School of Engineering, *Austin, Texas* 78712

DESCRIPTION: The location of features on the surface of Mars may be described in a system defined by the direction of the axis of rotation, the plane of the equator and by a zero meridian of longitude. Modern observations of the surface of Mars have yielded new values for these quantities. The purpose of this research is to prepare an ephemeris based on these new elements which can be used as a standard of comparison for all observations of Martian surface features, both ground-based and from space.

SUPPORTED BY University of Texas

10.0017, OBSERVATIONAL AND THEORETICAL STUDIES OF THE STRUCTURE AND EVOLUTION OF LATE-TYPE GALAXIES

R.J. TALBOT, Rice University, Graduate School, *Houston, Texas* 77001 (AST78-00924)

The research will provide quantitative observational data on the spatial distribution and rate of star formation in galaxies and use that data to develop a physical theory for the rate of formation of stars.

To accomplish the proposed work the proposers have developed a procedure for analyzing photographs of galaxies made at a variety of wavelengths. The colors determined for a particular location in a galaxy can be compared with evolutionary stellar population models to estimate the past rate of star formation at that location. Such rates can then be compared to physical theories based upon the dynamics of disk-shaped systems of gas and stars. The work will provide fundamental new insights into the chemical evolution of spiral galaxies, the origin, nature, and

maintenance of spiral structure in galaxies, and the nature of star formation processes in galaxies.

This work will be performed, in part, through the use of facilities for interactive picture processing at Rice University and with the Interactive Picture Processing System at the Kitt Peak National Observatory.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

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Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N78-30038*+ National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 97
Jun. 1978 121 p
(NASA-SP-7037(97)) Avail: NTIS HC E02 CSCL 01A

This bibliography lists 420 reports, articles, and other documents introduced into the NASA scientific and technical information system in May 1978. Author

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N78-30039*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC CHARACTERISTICS INDUCED ON A SUPERCRITICAL WING DUE TO VECTORING TWIN NOZZLES AT MACH NUMBERS FROM 0.40 TO 0.95
Francis J. Capone Aug. 1978 115 p refs
(NASA-CR-78746) Avail: NTIS HC A06/MF A01 CSCL 01A

The induced lift characteristics are studied for a vectored-thrust concept in which jet-exhaust nozzles were located in the fuselage at the wing trailing edge. The wing had a supercritical airfoil section. The investigation was conducted at Mach numbers from 0.4 to 0.95, angles of attack up to 14 deg, and thrust coefficients up to 0.35, and nozzle deflection angles of 0 deg and 30 deg. Separate force balances were used to determine both total aerodynamic and thrust forces alone which allowed for a direct measurement of jet turning angle at forward speeds. The Reynolds number per meter varied from 8.20 x 1 million to 12.80 x 1 million. The results show that the configuration with the supercritical wing generally had a better performance with respect to both lift augmentation and drag reduction than the same configuration with a 64 series airfoil. G.G.

N78-30040*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WIND-TUNNEL TESTING OF VTOL AND STOL AIRCRAFT
Harry H. Heyson Jul. 1978 81 p refs Presented at the Seminar on Aerodyn. of V/STOL Aircraft and Helicopters, University Park, Pa., 31 Jul. - 4 Aug. 1978
(NASA-TM-78750) Avail: NTIS HC A05/MF A01 CSCL 01A

The basic concepts of wind-tunnel boundary interference are discussed and the development of the theory for VTOL-STOL aircraft is described. Features affecting the wall interference, such as wake roll-up, configuration differences, recirculation limits, and interference nonuniformity, are discussed. The effects of the level of correction on allowable model size are shown to be amenable to generalized presentation. Finally, experimental confirmation of wind-tunnel interference theory is presented for jet-flap, rotor, and fan-in-wing models. Author

N78-30041*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STATUS OF AERIAL APPLICATIONS RESEARCH IN THE LANGLEY VORTEX RESEARCH FACILITY AND THE LANGLEY FULL-SCALE WIND TUNNEL
Frank L. Jordan, H. Clyde McLemore, and Michael B. Bragg (Illinois Univ.) Aug. 1978 12 p refs
(NASA-TM-78760) Avail: NTIS HC A02/MF A01 CSCL 01A

Small scale models of agricultural airplanes were tested and numerical methods were utilized to study interactions between the airplane wake and the dispersed spray and granular materials. Methods were developed to measure and predict dispersal transport and wake characteristics and dispersal techniques to obtain interactions more favorable to wide, uniform deposition patterns and reduced drift. In the full scale wind tunnel, full scale agricultural airplanes and dispersal systems for both liquid and solid applications were evaluated to improve aircraft aerodynamics and dispersal systems efficiency. The program status in these two facilities is reported with emphasis on wake interactions and dispersal systems research. G.G.

N78-30042*# Lockheed-California Co., Burbank.
REXOR 2 ROTORCRAFT SIMULATION MODEL VOLUME 1: ENGINEERING DOCUMENTATION Final Technical Report
J. S. Reaser and P. H. Kretsinger Jun. 1978 272 p refs Sponsored in part by AVRADCOM 3 Vol.
(Contract NAS1-14570)
(NASA-CR-145331; LR-28435-Vol-1) Avail: NTIS HC A12/MF A01 CSCL 01A

A rotorcraft nonlinear simulation called REXOR II, divided into three volumes, is described. The first volume is a development of rotorcraft mechanics and aerodynamics. The second is a development and explanation of the computer code required to implement the equations of motion. The third volume is a user's manual, and contains a description of code input/output as well as operating instructions. G.Y.

N78-30043*# Lockheed-California Co., Burbank.
REXOR 2 ROTORCRAFT SIMULATION MODEL VOLUME 2: COMPUTER IMPLEMENTATION Final Technical Report
J. S. Reaser and P. H. Kretsinger Jun. 1978 177 p ref Sponsored in part by Avradcom 3 Vol.
(Contract NAS1-14570)
(NASA-CR-145332; LR-28435-Vol-2) Avail: NTIS HC A09/MF A01 CSCL 01A

For abstract, see N78-30042.

N78-30044*# Lockheed-California Co., Burbank.
REXOR 2 ROTORCRAFT SIMULATION MODEL VOLUME 3: USER'S MANUAL Final Technical Report

J. S. Reaser and P. H. Kretsinger Jun. 1978 247 p ref
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(Contract NAS1-14570)
(NASA-CR-145333; LR-28435-Vol-3) Avail: NTIS HC A11/MF A01 CSCL 01A
For abstract, see N78-30042.

N78-30045*# Vought Corp., Hampton, Va.
DESIGN OF A LARGE SPAN-DISTRIBUTED LOAD FLYING-WING CARGO AIRPLANE WITH LAMINAR FLOW CONTROL
W. A. Lovell, J. E. Price, C. B. Quartero, R. V. Turriziani, and G. F. Washburn Jun. 1978 45 p refs
(Contract NAS1-13500)
(NASA-CR-145376) Avail: NTIS HC A03/MF A01 CSCL 01A

A design study was conducted to add laminar flow control to a previously design span-distributed load airplane while maintaining constant range and payload. With laminar flow control applied to 100 percent of the wing and vertical tail chords, the empty weight increased by 4.2 percent, the drag decreased by 27.4 percent, the required engine thrust decreased by 14.8 percent, and the fuel consumption decreased by 21.8 percent. When laminar flow control was applied to a lesser extent of the chord (approximately 80 percent), the empty weight increased by 3.4 percent, the drag decreased by 20.0 percent, the required engine thrust decreased by 13.0 percent, and the fuel consumption decreased by 16.2 percent. In both cases the required take-off gross weight of the aircraft was less than the original turbulent aircraft. Author

N78-30046*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SHOCKLESS AIRFOILS WITH THICKNESSES OF 20.6 AND 20.7 PERCENT CHORD ANALYTICALLY DESIGNED FOR A MACH NUMBER OF 0.68 AND A LIFT COEFFICIENT OF 0.40
Dennis O. Allison May 1976 38 p refs
(NASA-TM-X-73917) Avail: NTIS HC A03/MF A01 CSCL 01A

A 20.8 percent-thick airfoil shape was designed to have shockless inviscid flow at a Mach number of 0.68 and a lift coefficient of 0.40. In order to determine the actual airfoils which would yield this same shockless flow when viscous effects are included, boundary layer displacement thicknesses were subtracted from the inviscid shape for Reynolds numbers of 100 and 35 million. This process yielded airfoils with thicknesses of 20.7 and 20.6 percent, respectively. Subtraction of boundary layer displacement thicknesses for Reynolds numbers below 35 million yielded nonphysical airfoils, that is airfoils with negative thicknesses near tHe trailing edge. The pitching moment about the quarter-chord point at the design condition was -0.082 for the inviscid shape and, consequently, for both airfoils. Off-design calculations for the two airfoils were made using a computer program which provides for the interaction of the inviscid flow and boundary layer solutions. The pressure distributions of the airfoils were shockless for conditions from the design point to lower Mach numbers and lift coefficients. No boundary layer separation was predicted except in the last 3 percent chord on the upper surface. Author

N78-30047*# Boeing Military Airplane Development, Seattle, Wash.
USER'S MANUAL: SUBSONIC/SUPERSONIC ADVANCED PANEL PILOT CODE Technical Report, May 1977 - Feb. 1978
Jack Moran, Edward N. Tinoco, and Forrester T. Johnson Feb. 1978 127 p refs
(NASA Order A-36078-B)
(NASA-CR-152047) Avail: NTIS HC A07/MF A01 CSCL 01A

Sufficient instructions for running the subsonic/supersonic advanced panel pilot code were developed. This software was developed as a vehicle for numerical experimentation and it should not be construed to represent a finished production program. The pilot code is based on a higher order panel method using linearly varying source and quadratically varying doublet distributions for computing both linearized supersonic and subsonic flow over arbitrary wings and bodies. This user's manual contains complete input and output descriptions. A brief description of the method is given as well as practical instructions for proper configurations modeling. Computed results are also included to demonstrate some of the capabilities of the pilot code. The computer program is written in FORTRAN IV for the SCOPE 3.4.4 operations system of the Ames CDC 7600 computer. The program uses overlay structure and thirteen disk files, and it requires approximately 132000 (Octal) central memory words. F.O.S.

N78-30048*# Bihrle Applied Research, Inc., Jericho, N. Y.
STATIC AERODYNAMIC CHARACTERISTICS OF A TYPICAL SINGLE-ENGINE LOW-WING GENERAL AVIATION DESIGN FOR AN ANGLE-OF-ATTACK RANGE OF -8 DEG TO 90 DEG
William Bihrle, Jr., Billy Barnhart, and Paul Pantason Jul. 1978 466 p refs
(Contract NAS1-14849)
(NASA-CR-2971) Avail: NTIS HC A20/MF A01 CSCL 01A

Static force data obtained at the NASA Ames Research Center 12 foot Pressure Tunnel are presented in plotted form for a 1/7 scale, single-engine, low-wing general aviation airplane model. The configurations tested included the basic airplane, various airfoil shapes, tail designs, fuselage strakes and fuselage modifications as well as airplane components. The test conditions included an angle-of-attack and sideslip range of -8 to 90 and -10 to 30 degrees, respectively, at a Mach number of 0.2 for Reynolds numbers of 288,000 and 3,450,000. The data are presented without analysis. Author

N78-30049*# Bihrle Applied Research, Inc., Jericho, N. Y.
ROTARY BALANCE DATA FOR A TYPICAL SINGLE-ENGINE LOW-WING GENERAL AVIATION DESIGN FOR AN ANGLE-OF-ATTACK RANGE OF 30 DEG TO 90 DEG
William Bihrle, Jr., Randy S. Hultberg, and William Mulcay Jul. 1978 446 p refs
(Contract NAS1-14849)
(NASA-CR-2972) Avail: NTIS HC A19/MF A01 CSCL 01A

Aerodynamic characteristics obtained in a spinning flow environment utilizing a rotary balance located spin tunnel are presented in plotted form for a 1/5 scale single-engine low-wing general aviation airplane model. The configurations tested include the basic airplane, various airfoil shapes, tail designs, fuselage strakes and modifications as well as airplane components. Data are presented for pitch and roll angle ranges of 30 to 90 degrees and 10 to -10 degrees, respectively, and clockwise and counter-clockwise rotations covering an Omega b/2V range from 0 to .9. The data are presented without analysis. Author

N78-30050*# Neilsen Engineering and Research, Inc., Mountain View, Calif.
CALCULATION OF THE LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF UPPER-SURFACE-BLOWN WING-FLAP CONFIGURATIONS Final Report
Michael R. Mendenhall and Selden B. Spangler Aug. 1978 83 p refs
(Contract NAS1-14086)
(NASA-CR-3004; NEAR-TR-157) Avail: NTIS HC A05/MF A01 CSCL 01A

An engineering method for predicting the longitudinal aerodynamic characteristics of wing-flap configurations with upper surface blowing (USB) was developed. Potential flow models were incorporated into the prediction method: a wing and flap lifting surface model and a jet wake model. The wing-flap model used a vortex-lattice to represent the wing and flaps. The wing had an arbitrary planform and camber and twist, and the flap system was made up of a Coanda flap and other flap segments of arbitrary size. The jet wake model consisted of a series of closely spaced rectangular vortex rings. The wake was positioned such that it was tangent to the upper surface of the wing and flap between the exhaust nozzle and the flap trailing edge. It was specified such that the mass, momentum, and spreading rates were similar to actual USB jet wakes. Comparisons of measured and predicted pressure distributions, span load distributions, and total lift and pitching-moment coefficients on swept and unswept USB configurations are included. A wide range of thrust coefficients and flap deflection angles were considered at angles of attack up to the onset of stall. S.B.S.

N78-30051*# McDonnell-Douglas Corp., St. Louis, Mo.
MODIFICATION OF THE DOUGLAS NEUMANN PROGRAM TO IMPROVE THE EFFICIENCY OF PREDICTING COMPONENT INTERFERENCE AND HIGH LIFT CHARACTERISTICS Final Report
D. R. Bristow and G. G. Grose Aug. 1978 126 p refs
(Contract NAS1-14756)
(NASA-CR-3020) Avail: NTIS HC A07/MF A01 CSCL 01A

The Douglas Neumann method for low-speed potential flow on arbitrary three-dimensional lifting bodies was modified by substituting the combined source and doublet surface paneling based on Green's identity for the original source panels. Numerical studies show improved accuracy and stability for thin lifting surfaces, permitting reduced panel number for high-lift devices and supercritical airfoil sections. The accuracy of flow in concave corners is improved. A method of airfoil section design for a given pressure distribution, based on Green's identity, was demonstrated. The program uses panels on the body surface with constant source strength and parabolic distribution of doublet strength, and a doublet sheet on the wake. The program is written for the CDC CYBER 175 computer. Results of calculations are presented for isolated bodies, wings, wing-body combinations, and internal flow. Author

N78-30052*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
BOUNDARY-LAYER SEPARATION ON ISOLATED BOATTAIL NOZZLES M.S. Thesis - George Washington Univ.
William Kelly Abeyounis Aug. 1978 63 p refs
(NASA-TP-1226; L-12104) Avail: NTIS HC A04/MF A01 CSCL 10A

An angle of attack of 0 deg was investigated in the Langley 16 foot transonic tunnel at free-stream Mach numbers from 0.40 to 0.95 to study the phenomenon of separated flow on a series of circular-arc afterbodies. Both high-pressure air and solid circular cylinders with the cylinder diameter equal to the nozzle-exit diameter were used to simulate jet exhausts. The results indicate that boundary-layer separation is most extensive on steep boattails at high Mach numbers. The jet total-pressure ratio changes (jet total pressure to free-stream static pressure) affected the extent of separation very little; however, comparison of the separation data obtained by using the two jet-simulation techniques indicate that entrainment associated with the presence of a jet had a significant effect on the extent of separation. The solid-simulator separation data were also used to evaluate the predictions of eight separation criteria. S.E.S.

N78-30053*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STATIC AERODYNAMIC CHARACTERISTICS OF A WINGED SINGLE-STAGE-TO-ORBIT VEHICLE AT MACH NUMBERS FROM 0.3 TO 4.63
Delma C. Freeman and Roger H. Fournier Aug. 1978 119 p refs
(NASA-TP-1233; L-12200) Avail: NTIS HC A06/MF A01 CSCL 01A

The Langley 8 foot transonic pressure tunnel and the Langley Unitary Plan wind tunnel used to determine the longitudinal and lateral-directional aerodynamic characteristics of a winged single-state-to-orbit vehicle was investigated. The model was tested over a Mach number range from 0.3 to 4.63 for an angle-of-attack range from 4 to 30 D at both 0 and 5 D sideslip. S.E.S.

N78-30054*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPROXIMATE INDICIAL LIFT FUNCTION FOR TAPERED, SWEPT WINGS IN INCOMPRESSIBLE FLOW
M. J. Queijo, William R. Wells (Wright State Univ., Dayton, Ohio), and Dinesh A. Keskar (Cincinnati Univ., Ohio) Aug. 1978 32 p refs
(NASA-TP-1241; L-12110) Avail: NTIS HC A03/MF A01 CSCL 01A

An approximate indicial lift function associated with circulation was developed for tapered, swept wings in incompressible flow. The function is derived by representing the wings with a simple vortex system. The results from the derived equations compare well with the limited available results from more rigorous and complex methods. The equations, as derived, are not very convenient for calculating the dynamic response of aircraft, parameter extraction, or for determining frequency-response curves for wings. Therefore, an expression is developed to convert the indicial response function to an exponential form which is more convenient for these purposes. Author

N78-30055*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC CHARACTERISTICS AT MACH 6 OF A WING-BODY CONCEPT FOR A HYPERSONIC RESEARCH AIRPLANE
James L. Dillon and Jimmy L. Pittman Aug. 1978 59 p refs
(NASA-TP-1249; L-12183) Avail: NTIS HC A04/MF A01 CSCL 01A

The static aerodynamic characteristics of a 1/30 scale model of a wing-body concept for a high speed research airplane were investigated in the Langley 20 inch Mach six tunnel. The investigation consisted of configuration buildup from the basic body by adding a wing, center vertical tail, three-module scramjet, and six-module scramjet engine. The test Mach number was six at a Reynolds number, based on model fuselage length, of about 13,700,000. The test angle-of-attack range was 4 to 20 D at constant angles of sideslip of 0, 2, and 4 deg. The elevons were deflected from 10 to -15 D for pitch control. Roll and yaw control were investigated. Experimental aerodynamic characteristics are compared with analytical elements. S.B.S.

N78-30056*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THEORETICAL ESTIMATION OF THE TRANSONIC AERODYNAMIC CHARACTERISTICS OF A SUPERCRITICAL-WING TRANSPORT MODEL WITH TRAILING-EDGE CONTROLS
James M. Luckring and Michael J. Mann Aug. 1978 34 p refs
(NASA-TP-1253; L-11257) Avail: NTIS HC A03/MF A01 CSCL 01A

A method for rapidly estimating the overall forces and moments at supercritical speeds, below drag divergence, of transport configurations with supercritical wings is presented. The method was also used for estimating the rolling moments due to the deflection of wing trailing-edge controls. This analysis was based on a vortex-lattice technique modified to approximate the effects of wing thickness and boundary-layer induced camber. Comparisons between the results of this method and experiment indicate reasonably good correlation of the lift, pitching moment, and rolling moment. The method required much less storage and run time to compute solutions over an angle-of-attack range than presently available transonic nonlinear methods require for a single angle-of-attack solution. S.E.S.

N78-30057*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE WITH AND WITHOUT INLET RADIAL DISTORTION OF A TRANSONIC FAN STAGE DESIGNED FOR REDUCED LOADING IN THE TIP REGION
James F. Schmidt and Robert S. Ruggeri Aug. 1978 84 p refs
(NASA-TP-1294; E-9246) Avail: NTIS HC A05/MF A01 CSCL 01A

A transonic compressor stage designed for a reduced loading in the tip region of the rotor blades was tested with and without inlet radial distortion. The rotor was 50 cm in diameter and designed for an operating tip speed of 420 m/sec. Although the rotor blade loading in the tip region was reduced to provide additional operating range, analysis of the data indicates that the flow around the damper appears to be critical and limited the stable operating range of this stage. For all levels of tip and hub radial distortion, there was a large reduction in the rotor stall margin. Author

N78-30058# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
A CALCULATOR PROGRAM FOR ANALYZING AIRLOADS ON A WING OF ARBITRARY PLANFORM AND CAMBER IN SUBSONIC FLOW Final Report, 1 Apr. - 31 Aug. 1976

John C. Sparks Jan. 1978 53 p refs
(AD-A054180; AFFDL-TR-77-136) Avail: NTIS HC A04/MF A01 CSCL 20/4

A subsonic airloads program for small (8-K) calculators is presented. Features include good man-machine interaction and quick turn-around which speed preliminary design. The program is written in BASIC for the HP9830 or HP9831 calculator systems equipped with Matrix ROM and 9862A plotter. Programming techniques illustrated may be applied to any small system having special function keys or an equivalent capability.
Author (GRA)

N78-30059# Naval Surface Weapons Center, White Oak, Md. Advanced Weapons Dept.

BOUNDARY-LAYER TRANSITION EXPERIMENTS ON SHARP, SLENDER CONES IN SUPERSONIC FREEFLIGHT Final Report, Jul. 1975 - Sep. 1977

Daniel C. Reda Sep. 1977 70 p refs
(WR02302003)
(AD-A054591; NSWC/WOL/TR-77-59) Avail: NTIS HC A04/MF A01 CSCL 19/4

Boundary-layer transition experiments were conducted on sharp, slender cones in an aeroballistics range as part of the coordinated program for transition research recommended by the U.S. Transition Study Group. The present report documents all phases of this research program. GRA

N78-30060# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.

MODELING OF COHERENT STRUCTURE IN BOUNDARY LAYER TURBULENCE Interim Report

M. T. Landahl 1978 28 p refs
(Grant AF-AFOSR-2730-74)
(AD-A054851; AFOSR-78-0962TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

The large-scale coherent motion associated with turbulent bursting in a boundary layer is studied with the aid of an inviscid model. The space-time evolution of a disturbance of large horizontal dimensions compared to the wall layer thickness is analyzed under the assumption that the mean flow is parallel. The initial velocity field is assumed to be set up by the action of the turbulent stresses produced by a patch of secondary instability. For short and moderate times, the effects of viscosity and pressure are small, and the evolution of the disturbance is conveniently studied with the aid of Lagrangian techniques. The model is able to reproduce qualitatively many of the observed features of the bursting motion such as the formation of longitudinal streaks, the rapid acceleration after initiation of bursting, and the strong y-coherence of the u-fluctuations. In particular, the model demonstrates how action by the mean shear makes the disturbance eventually evolve into a thin internal shear layer, thus making possible the appearance of a new region of inflexional instability and hence burst regeneration-downstream of the original burst. Author (GRA)

N78-30061# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

HIGH SPEED UNSTEADY SEPARATION ABOUT CONCAVE BODIES: A PHYSICAL EXPLANATION

A. G. Panaras Sep. 1977 61 p refs
(VKI-TN-123) Avail: NTIS HC A04/MF A01

A physical explanation is given of the observed large amplitude instabilities of the flow about some families of concave bodies. By means of theoretical arguments and an interpretation of the experimental data, it is shown that the pulsation mode is due to the effect which an annular supersonic jet, appearing at the shock intersection point of the foreshock and aftershock, has on the separation bubble. It is also shown that the oscillation mode, which appears experimentally when the separation point coincides with the tip of the forebody, is most probably due to the reattachment mechanism not attaining equilibrium of the pressure. Author (ESA)

N78-30062# Centre National d'Etudes Spatiales, Toulouse (France).

APPLICATION OF SHELL THEORY TO THE COMPUTATION OF BALLOON SHAPE AT VARIOUS ALTITUDES [APPLICATION DE LA THEORIE DES COQUES AU CALCUL DE LA FORME DES BALLONS A DIFFERENTES ALTITUDES]

Jean-Claude Kosik Dec. 1977 43 p refs In FRENCH; ENGLISH summary
(CNES-NT-78) Avail: NTIS HC A03/MF A01

The equations which describe the shape of a balloon are derived from the general equations of axisymmetric shells. These equations are used to determine the shapes of a stratospheric balloon at different heights and the shape of a pressurized balloon. Author (ESA)

N78-30063# Royal Aircraft Establishment, Farnborough (England).

EUROPEAN RESEARCH PROGRAMME ON HYPERSONIC AERODYNAMICS - EUROHYP REVIEW 1976

S. C. Metcalf, ed., G. Winterfeld, ed. (DFVLR, Porz), and L. C. Squire, ed. (Cambridge Univ.) 1977 67 p refs
(RAE-TM-Aero-1716; BR58744) Avail: NTIS HC A04/MF A01

The recently completed and current work program on various aspects of hypersonic aerodynamics research being conducted in European research institutes are reviewed. Three main areas are covered - lifting bodies, propulsion aerodynamics, and real gas effects. In each of these sections all projects have been listed in specialized sub-sections to form a rapidly addressed index. Additionally, there is a brief description or comment on each project, together with references to published papers etc, and an up-to-date address for each contributor. Author (ESA)

N78-30064# Liverpool Univ. (England).

CALCULATIONS OF THE EFFECTS OF BLOWING FROM THE LEADING EDGES OF A CAMBERED DELTA WING

J. E. Barsby London Aeron. Res. Council 1978 53 p refs Supersedes ARC-36252 Sponsored in part by Sci. Res. Council and Univ. of East Anglia, Engl.
(ARC-R/M-3800; ARC-36252; BR61584) Avail: NTIS HC A03/MF A01; HMSO £5.26; PHI $20.20

The thin jet model applied to the study of the jet flap is combined with the vortex sheet model applied to the study of leading-edge separation, to study the effect of blowing from the leading-edges of a cambered wing. The numerical techniques used to solve problems of leading-edge separation were improved, and in the present investigation solutions were generated for various values of the lift, camber and blowing strength of the jet whose direction is restricted to lie in a plane normal to the free stream. Regions existed in the parameter space within which solutions could not be obtained and there were regions within which solutions were not unique. The downward deflection of the jet which is associated with the camber does not produce a lift increment due to blowing which is significantly larger than the increment produced by the same blowing momentum on a plane wing. However, the drag for a given lift when blowing is introduced is greatly reduced, and in some cases a negative drag is predicted. Author (ESA)

N78-30065# Cambridge Univ. (England). Engineering Dept.

LINEARIZED SUPERSONIC UNSTEADY FLOW IN CASCADES

T. Nagashima and D. S. Whitehead London Aeron. Res. Council 1978 39 p refs Supersedes ARC-37198
(ARC-R/M-3811; ARC-37198; BR61587) Avail: NTIS HC A03/MF A01; HMSO £4; PHI $15.30

A linearized theory is presented for the calculation of force and moment coefficients for two-dimensional cascades of blades in supersonic flow. The cases of both supersonic and subsonic axial velocity are treated. The perturbations are due to bending vibration, torsional vibration, and wakes shed from moving obstructions upstream. The method leads to analytical results in the quasi-steady case, and to a fast computer program for the general unsteady case. Results are in good agreement with previous work. The method can be used to predict forced vibration and flutter in transonic fan blades. Author (ESA)

N78-30066# Queen Mary Coll., London (England).

A MEAN CAMBERLINE SINGULARITY METHOD FOR TWO-DIMENSIONAL STEADY AND OSCILLATORY AEROFOILS AND CONTROL SURFACES IN INVISCID INCOMPRESSIBLE FLOW

B. C. Basu Aeron. Res. Council 1978 54 p refs Supersedes

QMC-EP-1019; ARC-37207
(ARC-CP-1391; QMC-EP-1019; ARC-37207) Avail: NTIS HC A04/MF A01; HMSO £2.50; PHI $9.70

A numerical method has been developed to calculate the pressure distribution on the surface of steady and oscillating airfoils in incompressible inviscid flow. In this method singularities are placed on the mean camber line of the airfoil and the boundary condition of tangency of flow is satisfied on the surface of the airfoil. Problems considered include steady single airfoils with and without control surfaces, a cascade of airfoils, airfoils oscillating in pitch, airfoils oscillating in heave, airfoils in harmonic travelling gusts and control surface oscillations. Comparison with analytic solutions, and other numerical methods, where available, are good. The main advantages of this method are the relatively fast computing times and the fact that the method converges satisfactorily in the limit of zero airfoil thickness. Author (ESA)

N78-30067# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
SOME AEROELASTIC EFFECTS IN AIRSHIPS
D. J. Newman Jul. 1977 173 p refs
(TT-7709) Avail: NTIS HC A08/MF A01

The possibilities of flutter in airships is examined. Particular attention is paid to the symmetric modes and the flutter determinant is set up for the six degrees of freedom involving hull bending, hull vertical translation, hull pitching, horizontal fin bending, horizontal fin torsion and elevator rotation. The vibration analysis is performed by a Rayleigh Ritz method, using assumed modes that satisfy the force boundary conditions as well as the geometric constraints. The results for the uniform test cases are within 0.2% of the known exact solutions for the first three modes. The unsteady aerodynamic leadings of the airship hull are calculated by the equivalent ellipsoid method and by a momentum method. The results obtained using the two methods are in reasonable agreement with one another. Author (ESA)

N78-30068# Queen Mary Coll., London (England). Dept. of Aeronautical Engineering.
TWO-DIMENSIONAL AEROFOILS AND CONTROL SURFACES IN SIMPLE HARMONIC MOTION IN INCOMPRESSIBLE INVISCID FLOW
B. C. Basu and G. J. Hancock Aeron. Res. Council 1978 62 p refs Supersedes ARC-37204
(ARC-CP-1392; ARC-37204) Avail: NTIS HC A04/MF A01; HMSO £3; PHI $11.55

A numerical method developed for the calculation of the two-dimensional potential flow about an airfoil of arbitrary shape undergoing small amplitude simple harmonic motions is described. Problems considered include airfoils oscillating in pitch, airfoils oscillating in heave, airfoils in harmonic travelling gusts and control surface oscillations. Comparison with analytic solutions, where available, is good. Significant differences between linear and non-linear theory are shown especially for the in-phase hinge moment coefficients. Author (ESA)

N78-30385# Volkswagen A.G., Wolfsburg (West Germany).
THE EFFECT OF AERODYNAMIC DRAG ON THE FUEL ECONOMY OF PASSENGER CARS
Hans J. Emmelmann *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 673-680 refs (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N78-30069*# Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.
DEMAND MODELLING OF PASSENGER AIR TRAVEL: AN ANALYSIS AND EXTENSION, VOLUME 2 Final Report
I. D. Jacobson Aug. 1978 151 p refs
(Grant NsG-7266)
(NASA-CR-157402; UVA/528148/MAE78/101) Avail: NTIS HC A08/MF A01 CSCL 01C

Previous intercity travel demand models in terms of their ability to predict air travel in a useful way and the need for disaggregation in the approach to demand modelling are evaluated. The viability of incorporating non-conventional factors (i.e. non-econometric, such as time and cost) in travel demand forecasting models are determined. The investigation of existing models is carried out in order to provide insight into their strong points and shortcomings. The model is characterized as a market segmentation model. This is a consequence of the strengths of disaggregation and its natural evolution to a usable aggregate formulation. The need for this approach both pedagogically and mathematically is discussed. In addition this volume contains two appendices which should prove useful to the non-specialist in the area. G.Y.

N78-30070*# Aeronautical Research Foundation, Cambridge, Mass.
REQUIREMENTS FOR REGIONAL SHORT-HAUL AIR SERVICE AND THE DEFINITION OF A FLIGHT PROGRAM TO DETERMINE NEIGHBORHOOD REACTIONS TO SMALL TRANSPORT AIRCRAFT
Kornel Feher, Lynn Bollinger, Jeffrey V. Bowles, and Mark H. Waters Aug. 1978 153 p refs Prepared in cooperation with NASA. AMES Res. Center, Moffett Field, Calif.
(Contract NAS2-9050)
(NASA-CR-152151) Avail: NTIS HC A08/MF A01 CSCL 05C

An evaluation of the current status and future requirements of an intraregional short haul air service is given. A brief definition of the different types of short haul air service is given. This is followed by a historical review of previous attempts to develop short haul air service in high density urban areas and an assessment of the current status. The requirements for intraregional air service, the need for economic and environmental viability and the need for a flight research program are defined. A detailed outline of a research program that would determine urban community reaction to frequent operations of small transport aircraft is also given. Both the operation of such an experiment in a specific region (San Francisco Bay area) and the necessary design modifications of an existing fixed wing aircraft which could be used in the experiment are established. An estimate is made of overall program costs. G.Y.

N78-30071# Federal Aviation Administration, Washington, D.C. Wind Shear/WVAS Branch.
ENGINEERING AND DEVELOPMENT PROGRAM PLAN: WAKE VORTEX
Dec. 1977 6 p refs
(AD-A051143; FAA-ED-21-1A) Avail: NTIS HC A02/MF A01 CSCL 01/5

The design, development, testing, and prototyping of a system to increase runway capacity by minimizing wake vortex effects as an impediment to efficient and effective traffic management in the terminal environment are discussed. Major work areas were: vortex advisory system, wake vortex avoidance system, and vortex alleviation research. S.B.S.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N78-30072*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CHARACTERISTICS OF CONSTRAINED OPTIMUM TRAJECTORIES WITH SPECIFIED RANGE

Heinz Erzberger and Homer Lee Sep. 1978 39 p refs
(NASA-TM-78519; A-7592) Avail: NTIS HC A03/MF A01 CSCL 17G

Necessary conditions of optimality are derived for trajectories whose structure is limited to climb, steady cruise, and descent segments. The performance function consists of the sum of fuel and time costs, referred to as direct operating cost (DOC). The state variable is range to go and the independent variable is energy. In this formulation a cruise segment always occurs at the optimum cruise energy for sufficiently large range. At short ranges (500 n. mi. and less) a cruise segment may also occur below the optimum cruise energy. The existence of such a cruise segment depends primarily on the fuel flow vs thrust characteristics and on thrust constraints. If thrust is a free control variable along with airspeed, it is shown that such cruise segments will not generally occur. If thrust is constrained to some maximum value in climb and to some minimum in descent, such cruise segments generally will occur. Computer calculations of typical short-range trajectories obtained about a 1% cost penalty for constraining the thrust. Author

N78-30073*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DESCRIPTION AND PERFORMANCE OF THE LANGLEY VISUAL LANDING DISPLAY SYSTEM
John D. Rollins Aug. 1978 74 p refs
(NASA-TM-78742) Avail: NTIS HC A04/MF A01 CSCL 17G

A television/model board system is described which provides a means of generating a six-degree-of-freedom visual out-the-window scene for the pilot of a simulated aircraft. The hardware and its performance of capability for meeting the visual requirements for a wide range of simulation studies are detailed. Also included is a description of the computer software required for the system. An example of software implementation in a real-time computer program is provided. G.G.

N78-30074*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLIGHT DEMONSTRATIONS OF CURVED, DESCENDING APPROACHES AND AUTOMATIC LANDINGS USING TIME REFERENCED SCANNING BEAM GUIDANCE
William F. White, comp. May 1978 269 p refs
(NASA-TM-78745) Avail: NTIS HC A12/MF A01 CSCL 17G

The Terminal Configured Vehicle (TCV) program operates a Boeing 737 modified to include a second cockpit and a large amount of experimental navigation, guidance and control equipment for research on advanced avionics systems. Demonstration flights to include curved approaches and automatic landings were tracked by a phototheodolite system. For 50 approaches during the demonstration flights, the following results were obtained: the navigation system, using TRSB guidance, delivered the aircraft onto the 3 nautical mile final approach leg with an average overshoot of 25 feet past centerline, subjet to a 2-sigma dispersion of 90 feet. Lateral tracking data showed a mean error of 4.6 feet left of centerline at the category 1 decision height (200 feet) and 2.7 feet left of centerline at the category 2 decision height (100 feet). These values were subject to a sigma dispersion of about 10 feet. Finally, the glidepath tracking errors were 2.5 feet and 3.0 feet high at the category 1 and 2 decision heights, respectively, with a 2 sigma value of 6 feet. G.G.

N78-30075# National Aviation Facilities Experimental Center, Atlantic City, N. J.
TRSB MICROWAVE LANDING SYSTEM DEMONSTRATION PROGRAM AT BRUSSELS, BELGIUM Final Report, 20 Jan. - 6 Feb. 1978
Feb. 1978 84 p
(AD-A054298; FAA-NA-78-18; FAA-RD-78-18) Avail: NTIS HC A05/MF A01 CSCL 01/5

The sixth in a series of FAA conducted operational demonstrations of several TRSB system configurations at selected airports in the United States and abroad are reported. The basic wide aperture TRSB was installed to service runway 07L which was the longest of three major runways at the airport. Operational demonstrations and data acquisition flights were made using FAA CV-880 and B-727 aircraft. One-third of the landings were autoland. Flight profiles included straight-in and curved approaches, radials, and partial orbits. Results of the operational demonstrations indicate that the performance of the TRSB basic wide system configuration meets the ICAO full capability system requirements. B.B.

N78-30076# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.
LAYING AND AIMING STUDY FOR ADVANCED LAND COMBAT SYSTEMS, PART 2
James V. Johnston 22 Feb. 1978 12 p
(AD-A054127; DRDMI-T-78-43-Pt-2) Avail: NTIS HC A02/MF A01 CSCL 17/7

New developments in inertial equipment have led to new guidance mechanizations. Computer technology in the past ten years has made outstanding advances in size speed, and lower cost. These advances have brought to the forefront the implementation of strapdown guidance. The purpose of this report is to update a previous study to include strapdown mechanizations. Author (GRA)

N78-30077# Naval Surface Weapons Center, Dahlgren, Va.
NAVIGATION FORMULATION FOR AN EARTH FIXED NAVPAC Final Report
Bruce Hermann Mar. 1978 36 p
(AD-A054596; NSWC/DL/TR-3746) Avail: NTIS HC A03/MF A01 CSCL 22/2

This report describes the formulation required to convert the observations of navigation transmissions from the Navy Navigation Satellites into a two-dimensional position solution. This particular application is for the performance testing of the NAVPAC multisatellite receiver. Author (GRA)

N78-30078# Facility Checking Squadron (1866th) (AFCS), Scott AFB, Ill.
TRACALS EVALUATION REPORT. TACAN, VOR, AND ILS STATION EVALUATION REPORT, ANDERSEN AFB, GUAM Final Report, 25 Jul. - 15 Aug. 1977
Paul W. Nix 12 Apr. 1978 253 p
(AD-A054244; Rept-77/66N-107) Avail: NTIS HC A12/MF A01 CSCL 17/7

This evaluation report presents data collected and analyzes capabilities and limitations of the Andersen AFB TACAN (AN/GRN-19A), VOR (AN/FRN-38), ILS (AN/MRN-7A/8A) and their associated power systems. The evaluation was conducted from 25 July to 15 August 1977. The results of the evaluation indicate that all the facilities are capable of providing satisfactory service. The data presented in this report can be used as a valid guide to anticipated performance until there is a significant change in ground equipment, siting or screening. Author (GRA)

N78-30079# Arinc Research Corp., Annapolis, Md.
EVALUATION OF METHODS FOR CALCULATING SYSTEM OPERATING TIME IN ACCORDANCE WITH RELIABILITY IMPROVEMENT WARRANTY (RIW) CONTRACTUAL TERMS Final Report, 15 Aug. 1977 - 15 Feb. 1978
A. A. Bilodeau and P. M. Dallosta Mar. 1978 192 p refs
(Contract F09603-77-A-3104)
(AD-A054822; Rept-1928-01-1-1704) Avail: NTIS HC A09/MF A01 CSCL 17/7

Arinc Research Corporation conducted a six-month study to investigate the validity of contractual techniques for calculating warranty statistics for the AN/ ARN-118 V TACAN. TACAN field data were collected from eleven U.S. Air Force Bases by Arinc Research. Additional TACAN data submitted by the Air Force were used in support of this study. Average Operating Time AOT, Total Operating Hours TOH, and Mean Time Between Failures MTBF based on these field data were compared with the values of these parameters calculated by contractual methods. No significant differences between field data estimates and the contractual-methods of calculation were identified. Author (GRA)

N78-30080# Arinc Research Corp., Annapolis, Md.
AVIONICS COST DEVELOPMENT FOR ALTERNATIVES OF SELECTED AIR TRAFFIC CONTROL SYSTEMS Final Report
S. H. Kowalski Oct. 1977 71 p refs
(Contract DOT-FA76WA-3788)
(AD-A054823; Rept-1326-01-3-1758) Avail: NTIS

HC A04/MF A01 CSCL 17/7

This report presents the results of the cost analysis of avionics required in support of the Upgraded Third Generation Air Traffic Control developments. The systems considered were recommended for evaluation by the Office of Systems Engineering Management of the FAA. The costs of avionics were developed with the aid of a pricing model to provide comparative evaluations based on uniform parametric data varying only in system-peculiar descriptors. Author (GRA)

N78-30081# Sandia Labs., Albuquerque, N. Mex.
POSITION-ESTIMATION ERROR ANALYSIS OF A BEACON RANGING SYSTEM
W. D. Lyle, Jr. Nov. 1977 42 p refs
(Contract EY-76-C-04-0789)
(SAND-77-1439) Avail: NTIS HC A03/MF A01

The variance of maximum likelihood position estimates using a beacon ranging system is derived. Numerical results are presented to illustrate how position accuracy depends on number of beacons and beacon location errors. ERA

N78-30082# Royal Aircraft Establishment, Farnborough (England).
STUDY OF TRAFFIC PACKING OVER THE NORTH ATLANTIC
Rosalind S. Sheil Jul. 1977 36 p refs
(RAE-TM-Math-Comp-7703; BR59796) Avail: NTIS HC A03/MF A01

The work first carried out by P. P. Scott on North Atlantic data for 1967 is updated - data for 1973 is now examined. Relationships between the number of daily North Atlantic flights in 1973 are found by measuring the occupancies of the tracks and flight levels which are adjacent to those of a typical aircraft. These results are used to construct a flight request pattern required as input data to a simulation model which forecasts the density with which aircraft will be packed into the North Atlantic track system as the traffic flow increases in future years. Repeated runs of the model with a series of traffic flow rates have enabled the packing density to be expressed as a function of traffic intensity. Author (ESA)

N78-30083# National Technical Information Service, Springfield, Va.
LORAN C NAVIGATION. CITATIONS FROM THE NTIS DATA BASE Final Report, 1964 - Mar. 1978
William E. Reed May 1978 130 p Supersedes NTIS/PS-77-0336
(NTIS/PS-78/0531/0; NTIS/PS-77/0336) Avail: NTIS HC $28.00/MF $28.00 CSCL 17G

A bibliography containing 123 abstracts concerning the use of Loran C for air and maritime navigation, including coastal confluence and inland waters; automatic vehicle location and tracking; distress systems; portable land position finding; meteorological and atmospheric data acquisition; time and frequency synchronization; and position fixing is presented. Also included are research on Loran C equipment and signal propagation. GRA

N78-30084# National Technical Information Service, Springfield, Va.
LORAN C NAVIGATION. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Final Report, 1970 - Mar. 1978
William E. Reed Jun. 1978 116 p Supersedes NTIS/PS-77-0337
(NTIS/PS-78/0532/8; NTIS/PS-77/0377) Avail: NTIS HC $28.00/MF $28.00 CSCL 17G

A bibliography containing 109 abstracts concerning the use of Loran C for air and maritime navigation, including coastal confluence and inland waters; automatic vehicle locating and tracking; meteorological and atmospheric data acquisition; position fixing, and time and frequency synchronization is presented. Also included are research on Loran C equipment and signal propagation. GRA

N78-30085# National Technical Information Service, Springfield, Va.
OMEGA NAVIGATION SYSTEM. CITATIONS FROM THE NTIS DATA BASE Final Report, 1964 - Apr. 1978
William E. Reed Jun. 1978 287 p Supersedes NTIS/PS-77/0463; NTIS/PS-76/0363; NTIS/PS-75/151
(NTIS/PS-78/0556/7; NTIS/PS-77/0463; NTIS/PS-76/0363; NTIS/PS-75/151) Avail: NTIS HC $28.00/MF $28.00 CSCL 17G

A bibliography containing 279 abstracts concerning the development and utilization of the Omega navigation system is presented. Research on signal propagation, equipment, and operational evaluation is presented. Studies on differential Omega are also included. GRA

N78-30086# National Technical Information Service, Springfield, Va.
OMEGA NAVIGATION SYSTEM. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Final Report, 1970 - Apr. 1978
William E. Reed Jun. 1978 186 p Supersedes NTIS/PS-77/0464; NTIS/PS-76/0364
(NTIS/PS-78/0557/5; NTIS/PS-77/0464; NTIS/PS-76/0364) Avail: NTIS HC $28.00/MF $28.00 CSCL 17G

A bibliography containing 179 abstracts concerning research reports on the development and utilization of the Omega navigation system was cited. Topics include signal propagation, equipment, and operational evaluation. Studies on Differential Omega are also covered. ERA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N78-30087*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STABILITY AND PERFORMANCE CHARACTERISTICS OF A FIXED ARROW WING SUPERSONIC TRANSPORT CONFIGURATION (SCAT 15F-9898) AT MACH NUMBERS FROM 0.60 TO 1.20
John P. Decker and Peter F. Jacobs Jun. 1978 354 p refs
(NASA-TM-78726) Avail: NTIS HC A16/MF A01 CSCL 01C

Tests on a 0.015 scale model of a supersonic transport were conducted at Mach numbers from 0.60 to 1.20. Tests of the complete model with three wing planforms, two different leading-edge radii, and various combinations of component parts, including both leading- and trailing-edge flaps, were made over an angle-of-attack range from about -6 deg to 13 deg and at sideslip angles of 0 deg and 2 deg. Author

N78-30088# National Aviation Facilities Experimental Center, Atlantic City, N. J.
A PRELIMINARY COMPARISON OF THERMAL DECOMPOSITION PRODUCTS OF AIRCRAFT INTERIOR MATERIALS USING THE NATIONAL BUREAU OF STANDARDS SMOKE CHAMBER AND THE COMBUSTION TUBE FURNACE
Louise C. Speitel, Ray E. Feher, and Joe C. Spurgeon Mar. 1978 34 p refs
(AD-A054811; FAA-NA-77-22) Avail: NTIS HC A03/MF A01 CSCL 01/3

Twelve aircraft interior materials were burned under standard flaming combustion conditions in a smoke chamber. Each material was also exposed to 600 Celsius in a combustion tube furnace under conditions of oxidative pyrolysis. The combustion products were collected in liquid-filled impingers, and the contents were analyzed for hydrogen cyanide, hydrogen sulfide, hydrogen chloride, hydrogen bromide, and formaldehyde by differential pulse polarography, nitrogen dioxide and sulfur dioxide by visible spectrophotometry, and hydrogen fluoride by ion-selective electrode. Carbon monoxide was measured directly by a nondispersive infrared analyzer. The yields of the nine gases are reported in terms of milligrams per gram of material. The toxic gas yields were obtained for each material in the smoke chamber and compared to the yields obtained in the combustion tube

furnace. The yields were also compared to those obtained using colorimetric detector tubes. The extent of the correlation of the various procedures is reported. The relative yields of HCl, HCN, and H2S were found to be somewhat independent of the exposure conditions. The relative yields of the oxidized gases, CO, HCHO, NO2, and SO2, are much more dependent on the exposure conditions. G.G.

N78-30089*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EVALUATION OF SEVERAL SECONDARY TASKS IN THE DETERMINATION OF PERMISSIBLE TIME DELAYS IN SIMULATOR VISUAL AND MOTION CUES

G. Kimball Miller, Jr. and Donald R. Riley Aug. 1978 68 p refs

(NASA-TP-1214; L-12006) Avail: NTIS HC A04/MF A01 CSCL 05H

The effect of secondary tasks in determining permissible time delays in visual-motion simulation of a pursuit tracking task was examined. A single subject, a single set of aircraft handling qualities, and a single motion condition in tracking a target aircraft that oscillates sinusoidally in altitude were used. In addition to the basic simulator delays the results indicate that the permissible time delay is about 250 msec for either a tapping task, an adding task, or an audio task and is approximately 125 msec less than when no secondary task is involved. The magnitudes of the primary task performance measures, however, differ only for the tapping task. A power spectraldensity analysis basically confirms the result by comparing the root-mean-square performance measures. For all three secondary tasks, the total pilot workload was quite high. S.B.S

N78-30090*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SIMULATOR STUDY OF THE EFFECT OF VISUAL-MOTION TIME DELAYS ON PILOT TRACKING PERFORMANCE WITH AN AUDIO SIDE TASK

Donald R. Riley and G. Kimball Miller, Jr. Aug. 1978 74 p refs

(NASA-TP-1216; L-11996) Avail: NTIS HC A04/MF A01 CSCL 05H

The effect of time delay was determined in the visual and motion cues in a flight simulator on pilot performance in tracking a target aircraft that was oscillating sinusoidally in altitude only. An audio side task was used to assure the subject was fully occupied at all times. The results indicate that, within the test grid employed, about the same acceptable time delay (250 msec) was obtained for a single aircraft (fighter type) by each of two subjects for both fixed-base and motion-base conditions. Acceptable time delay is defined as the largest amount of delay that can be inserted simultaneously into the visual and motion cues before performance degradation occurs. A statistical analysis of the data was made to establish this value of time delay. Audio side task provided quantitative data that documented the subject's work level. S.E.S.

N78-30091# Princeton Univ., N. J. Dept. of Aerospace and Mechanical Sciences.

A STUDY OF THE PRECISION HOVER CAPABILITIES OF THE AEROCRANE HYBRID HEAVY LIFT VEHICLES Final Report

H. C. Curtiss, Jr., W. F. Putnam, and R. M. McKillip, Jr. Feb. 1978 144 p refs

(Contract N62269-77-C-0074; WF41411000)

(AD-A054281; AMS-TR-1363; NADC-76341-30) Avail: NTIS HC A07/MF A01 CSCL 01/3

An analytical study of the precision hover capabilities of the AEROCRANE, based on equations of motion verified by flight tests of a dynamic model, is described. Two methods of control (cyclic pitch and winglets) are examined. A real time simulation of the tasks of hovering a proposed large AEROCRANE in gusts and translating from point to point was conducted to evaluate the two control methods and to compare the AEROCRANE with proposed large helicopters. The stability and control characteristics of large AEROCRANES are compared with those of proposed large helicopters and the helicopter handling qualities specifications. The results of the study indicate that winglets provide a very effective means of hover control. With cyclic control, the precision hover capabilities of the AEROCRANE are similar to helicopters of equivalent gross weight. Extrapolation of helicopter handling qualities specifications to large gross weight characteristic of proposed large AEROCRANES indicates that the configurations studied can meet these specifications. Certain aspects of hovering control which are characteristic of any vehicle which derives an appreciable portion of its lift from buoyancy and carries a heavy sling load are examined. Author (GRA)

N78-30092# North Carolina State Univ., Raleigh. Dept. of Mechanical and Aerospace Engineering.

INVESTIGATION OF A WING-ROTOR INTERACTION SYSTEM FOR HELICOPTERS Final Report, 1 Sep. 1973 - 31 Dec. 1977

Fred R. DeJarnette, Neal T. Frink, Mohammad A. Takallu, Steven L. Griffith, and James J. Murray 6 Mar. 1978 67 p refs

(Grants DAHC04-74-G-0007; DAHC04-75-G-0023; DAAG29-76-G-0045; DAAG29-76-G-0318)

(AD-A054093; ARO-11945.2-E; ARO-1357.2-E) Avail: NTIS HC A04/MF A01 CSCL 20/4

This research includes experimental and analytical investigations to determine if favorable interference effects could be obtained from a wing-rotor interaction system. Lift and drag forces were measured on a wing, mounted in a cantilever fashion from the wall, and on a proprotor positioned above the wing on a shaft which ran through the ceiling of the test section. Test results showed significant increases in lift and decreases in drag for both the wing and the proprotor due to favorable interference effects. The analytical investigation developed a new lifting surface theory for subsonic wings which can also be interpreted as a vortex lattice method. Results were found to be more accurate and converge faster than conventional vortex lattice methods. The accuracy compared well with other lifting surface theories, but with much smaller computational times. GRA

N78-30093# Douglas Aircraft Co., Inc., Long Beach, Calif.

DAMPING, STATIC, DYNAMIC, AND IMPACT CHARACTERISTICS OF LAMINATED BEAMS TYPICAL OF WINDSHIELD CONSTRUCTION Final Report, Jul. 1975 - Nov. 1976

G. F. Rhodes Dec. 1977 279 p refs

(Contract F33615-75-C-3105; AF Proj. 2202)

(AD-A054463; MDC-J6944; AFFDL-TR-76-156) Avail: NTIS HC A13/MF A01 CSCL 11/9

This eight section report contains the test plans, test results and analyses for a series of monolithic and laminated transparent beams which represent aircraft windshield segments. A method of imbedding strain gages, mounting strain gages, and the application of thermocouples is described. The method of data collection was assessed for data reduction that could provide stress-strain relationships. These relationships were used for the determination of energy transfer, dynamic response, and displacements due to applied loads. Selected portions of the test data were correlated with data output in a math model representation of test specimens noted in Section 9 of AFFDL-TR-77-1. Eleven cantilevered damping specimens were tested at various levels in order to study the damping characteristics for each ply of the laminate utilizing strain recordings. The strain responses were checked for accuracy with respect to theoretical strains calculated as a function of the applied loads. GRA

N78-30094# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.

COMPUTER PROGRAM FOR VIBRATION PREDICTION OF FIGHTER AIRCRAFT EQUIPMENTS Final Report, 21 Mar. 1976 - 15 Apr. 1977

Robert W. Sevy and Mark N. Haller Nov. 1977 218 p refs

(AF Proj. 6146)

(AD-A054598; AFFDL-TR-77-101) Avail: NTIS HC A10/MF A01 CSCL 01/3

This study details in-house efforts that culminate in a computer program for the prediction of vibration inputs to equipments mounted in fighter aircraft. The computer format is orchestrated about a basic function whose thematic variations are invoked to describe boundary layer excitations and to synthesize a sequence of transfer functions whose operations, in turn, define the resultant vibration spectrum; beginning at the aircraft surface and proceeding inward to the designated equipment. Program inputs specify flight conditions, aircraft structural classes, equipment

weight, equipment locational coordinates, and mounting categories in order to characterize vibration inputs of fighter aircraft equipments during flight attitudes ranging from straight and level states to a variety of significant flight maneuvers and phases. Program outputs, digital and graphical, are designed to provide the direct spectral information necessary to assemble sequential vibration histories corresponding to fighter aircraft mission profiles. Author (GRA)

N78-30095# Boeing Vertol Co., Philadelphia, Pa.
HELICOPTER TRANSMISSION VIBRATION AND NOISE REDUCTION PROGRAM. VOLUME 2: USER'S MANUAL Final Report, Jun. 1974 - Oct. 1977
John J. Sciarra, Robert W. Howells, Joseph W. Lenski, Jr., and Raymond J. Drago Mar. 1978 430 p refs
(Contract DAAJ02-74-C-0040; DA Proj. 1G2-62207-AH-8902) (AD-A054827; D210-11236-2-Vol-2; USARTL-TR-78-2B) Avail: NTIS HC A19/MF A01 CSCL 01/3

The objective of the Helicopter Transmission Vibration/Noise Reduction Program was to generate analytical tools for the prediction and reduction of helicopter transmission vibration/noise that provide the capability to perform trade studies during the design stage of a program. Application of this optimization capability yields drive train components that are dynamically quiet with reduced vibration/noise levels and inherently longer life. The work conducted under this program is highly computer-oriented and makes extensive use of several computer programs as indicated in the technical report (Volume I). This User's Manual describes these computer programs, presents rationale for their use, and discusses their application. Author (GRA)

N78-30096# Fiber Science, Inc., Gardena, Calif.
REMOTELY PILOTED VEHICLE (RPV) STRUCTURAL COMPONENTS INVESTIGATION Final Report, Jun. 1976 - May 1977
Sam Yao and Dale P. Abildskov Feb. 1978 81 p
(Contract DAAJ02-76-C-0040; DA Proj. 1F2-62209-AH-7600) (AD-A054828; USARTL-TR-77-53) Avail: NTIS HC A05/MF A01 CSCL 01/3

The mechanical properties of the open-weave filament-wound material called 'Spacewind' were evaluated both analytically and experimentally. As a demonstration of the feasibility of using Spacewind, the body and wing for the AQUILA remotely piloted vehicle were designed, fabricated, tested, and proven successful. Author (GRA)

N78-30097# Royal Aircraft Establishment, Farnborough (England).
DIVERSE FORMS AND DERIVATIONS OF THE EQUATIONS OF MOTION OF DEFORMABLE AIRCRAFT AND THEIR MUTUAL RELATIONSHIP
D. L. Woodcock Jun. 1977 123 p refs
(RAE-TR-77077; BR59543) Avail: NTIS HC A06/MF A01

The equations of motion of an aircraft, for small perturbations from flight with constant linear and zero angular velocities, are developed in detail using constant-velocity or body-fixed axes, encastre or free-free modes, displacement or velocity body freedom coordinates. The relationship is clearly stated between these various forms; and with other proposed forms, in particular those using mean-body axes. Author (ESA)

N78-30098# Royal Aircraft Establishment, Bedford (England). Structures Dept.
FLIGHT MEASUREMENTS OF THE EFFECTS OF SIMULATED LEADING-EDGE EROSION ON HELICOPTER BLADE STALL, TORSIONAL LOADS AND PERFORMANCE
P. Brotherhood and D. W. Brown London Aeron. Res. Council 1978 31 p refs Supersedes RAE-TR-76039; ARC-37053 (ARC-R/M-3809; RAE-TR-76039; ARC-37053) Avail: NTIS HC A03/MF A01; HMSO £3.50; PHI $13.45

The leading edges of the main rotor blades of a Wessex helicopter were artificially roughened to simulate light to moderate erosion of unprotected light alloy blades. Pitch link loads were measured in forward flight for various spanwise extents of leading-edge roughness, and the values of forward speed at which a pre-set limit of oscillatory pitch link load was reached were determined. This limit was set so as to avoid excessive fatigue damage to the modified control linkage. With a representative length of roughness, the speed at which the limit load occurred was reduced by 24 kn. This marked reduction was associated with premature blade stall, detected by trailing edge pressure measurements, and subsequent stall flutter with an increased power requirement. Author (ESA)

N78-30099# Advisory Group for Aerospace Research and Development, Paris (France).
FIGHTER AIRCRAFT DESIGN
Jun. 1978 292 p refs Partly in ENGLISH and FRENCH Presented at the Multi-Panel Symp. on Fighter Aircraft Design, Florence, 3-6 Oct. 1977
(AGARD-CP-241; ISBN-92-835-0215-9) Avail: NTIS HC A13/MF A01

The state of technology as related to future fighter aircraft design is assessed in terms of military requirements for the 80's. System design approach, aerodynamics and aircraft configurations, propulsion, structures design, avionics/guidance, and human factors are among to topics covered. For individual titles, see N78-30100 through N78-30118.

N78-30100# Hawker Siddeley Aviation Ltd., Kingston upon Thames (England).
TECHNOLOGY DEVELOPMENT TO MEET THE MILITARY REQUIREMENTS
R. S. Hooper *In* AGARD Fighter Aircraft Design Jun. 1978 12 p (For primary document see N78-30099 21-05)
Avail: NTIS HC A13/MF A01

Various factors characterizing fighter aircraft are considered with emphasis on airborne agility and survivability. Types of fighter aircraft identified include: interceptor, air combat, and ground attack. Wing and span loading and engine characteristics are also discussed. J.M.S.

N78-30101# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
ASSURING COMBAT PILOT EFFECTIVENESS
David L. Carleton *In* AGARD Fighter Aircraft Design Jun. 1978 8 p refs (For primary document see N78-30099 21-05)
Avail: NTIS HC A13/MF A01

Pilot selection and training concepts are discussed. Maintaining a high level of proficiency during peacetime is emphasized. Specific programs cited include: fighter lead-in training; graduated combat capability; red flag program; and mission simulator. These programs provide for basic tactics training as well as specific mission capabilities and monitoring and assessing the pilot's performance. The impact of specialized training philosophy on the design criteria for specialized airframes is considered. J.M.S.

N78-30102# Breguet-Aviation, Saint Cloud (France).
PERFECTING ARMAMENTS IN THE FAMILY OF MIRAGE AIRCRAFT [LA MISE AU POINT DES ARMEMENTS DANS LA FAMILLE DES MIRAGE]
M. B. Revellin-Palcoz *In* AGARD Fighter Aircraft Design Jun. 1978 2 p In FRENCH (For primary document see N78-30099 21-05)
Avail: NTIS HC A13/MF A01

The different versions of the Mirage aircraft such as the Mirage 3, Mirage 4, Mirage 5, FI Mirage and the Mirage 2000 are capable of carrying a large variety of amaments such as bombs, rockets, and air-to-air missiles or air-to-ground missiles. Methods of perfecting and testing these armaments were developed from the initial stage of study, to the drawing stage and including the final stage of flight operations. Various characteristic aspects of these successive stages are reported in detail. Trans. by B.B.

N78-30103# Preyss (Scott) Associates, Los Angeles, Calif.
AIR COMBAT
Albert E. Preyss *In* AGARD Fighter Aircraft Design Jun. 1978 16 p refs (For primary document see N78-30099 21-05)
Avail: NTIS HC A13/MF A01

A solution to the generalized multiple component engagement of opposing military forces is presented. The results provide detailed insights through the use of asymptotic models, human interactive analysis, and topological arguments. The technique is demonstrated by example, using the fighter escort problem. Application to any air combat problem of reasonable dimension

is possible. Aircraft performance, avionics, and weaponry are considered. The results can be used to guide the allocation of research and development resources, to evaluate the force mix problem related to new weapon system purchases, and to advise operational commands of deployment and tactics for known forces. J.M.S.

N78-30104# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
ADVANCED CONTROL CONCEPTS FOR FUTURE FIGHTER AIRCRAFT
Horst Wunnenberg and Wolfgang J. Kubbat (Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn, West Ger.) *In* AGARD Fighter Aircraft Design Jun. 1978 15 p refs (For primary document see N78-30099 21-05)
Avail: NTIS HC A13/MF A01

In detail the possibilities and limits of new control concepts such as active control technology and reduced static stability and the criteria for the corresponding control surface layout are discussed. Requirements and the technical realization methods for a modern fly by wire digital control technology are presented. Comments on current research programs and future prospects are given. J.M.S.

N78-30105# McDonnell Aircraft Co., St. Louis, Mo.
FIGHTER SUPERIORITY BY DESIGN
W. P. Murden, H. D. Altis, and M. L. Ramey *In* AGARD Fighter Aircraft Design Jun. 1978 16 p (For primary document see N78-30099 21-05)
Avail: NTIS HC A13/MF A01

Aspects of the F-18 program are discussed in terms of increasing combat effectiveness and decreasing combat costs. Combat performance, firepower and weapon system capability, multimission versatility, increased reliability and maintainability, and combat survivability are among the factors considered. J.M.S.

N78-30106# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France). Div. des Etudes Avancees.
AERODYNAMICS OF THE NEW GENERATION OF COMBAT AIRCRAFT WITH DELTA WINGS [AERODYNAMIQUE DE LA NOUVELLE GENERATION D'AVIONS DE COMBAT A AILE DELTA]
M. Pierre Bohn *In* AGARD Fighter Aircraft Design Jun. 1978 13 p In FRENCH (For primary document see N78-30099 21-05)
Avail: NTIS HC A13/MF A01

Utilization of various aerodynamic configurations for modern delta wing combat aircraft is discussed in relation to approach speeds and reducing impact damage at Supersonic speeds. Mission requirements such as maneuverability were examined in detail, and principle reasons for the discontinuation of fixed winged aircraft for combat were illustrated. Transl. by B.B.

N78-30107# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
SUPERCRUISER FIGHTER ANALYSIS
L. Earl Miller and Valentine Dahlem, III *In* AGARD Fighter Aircraft Design Jun. 1978 16 p (For primary document see N78-30099 21-05)
Avail: NTIS HC A13/MF A01

A fighter aircraft that cruises efficiently at supersonic speeds and is effective in air to air combat is considered. Supersonic cruise performance and transonic maneuvering requirements are emphasized. Speed advantage, ability to engage or disengage at will, maintaining control over the combat arena, and target acquisition are among the factors analyzed. From differential game technology, supercruiser maneuvering requirements are determined as a function of the threat's maneuvering capability. Wind tunnel results indicate that a small single aircraft can be configured to produce the level of efficiency necessary for supersonic cruise. J.M.S.

N78-30108# Naval Air Systems Command, Washington, D. C.
ANALYSIS OF ADVANCED VARIABLE CAMBER CONCEPTS
R. F. Siewert and R. E. Whitehead (ONR, Arlington, Va.) *In* AGARD Fighter Aircraft Design Jun. 1978 21 p refs (For primary document see N78-30099 21-05)
Avail: NTIS HC A13/MF A01

A survey of variable camber devices used on contemporary fighter aircraft to improve maneuverability in the air combat flight regime is presented. Variable camber concepts which offer potential for even greater benefits on future fighter aircraft designs are discussed. Finally, some analysis is presented which provides insight into the advantages that are achieved in various off design conditions with the use of these variable camber concepts. J.M.S.

N78-30109# Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).
VARIABLE-CYCLE ENGINE FIGHTER AIRCRAFT: ADVANCE IN PERFORMANCE AND DEVELOPMENT PROBLEMS
H. Grieb, W. Weiler, and G. Weist *In* AGARD Fighter Aircraft Design Jun. 1978 16 p refs Sponsored by Min. of Defence of Federal Rep. of Ger. (For primary document see N78-30099 21-05)
Avail: NTIS HC A13/MF A01

The requirements on engines for civil and military supersonic aircraft and the interest in variable cycle engines are explained. In addition, the variable cycle engine concepts and their function are described briefly. For two concepts of variable cycle engines for fighter aircraft, the operating characteristics, performance data, and leading design features are discussed. These examples are used to contrast the advances offered by such engines against the problems to be overcome. It is shown that, whereas the desired flexibility in operating characteristic and performance is feasible, the extra engine weight and complexity compared with conventional engines is very substantial. For a fighter aircraft, a simplified comparison of effectivity is made between the installation of variable cycle engine concepts and two types of conventional engines with different bypass ratio. It is shown that the extra weight to be expected with variable cycle engines investigated so far, does not justify their future application. J.M.S.

N78-30110# National Gas Turbine Establishment, Farnborough (England).
INTAKE DESIGN FOR FIGHTER AIRCRAFT
J. Dunham *In* AGARD Fighter Aircraft Design Jun. 1978 15 p refs Sponsored in part by RAE (For primary document see N78-30099 21-05)
Avail: NTIS HC A13/MF A01

An outline is given of the requirements placed upon the intake designer. Low external drag, high intake pressure recovery, and low distortion of the engine face flow are demanded, over a wide range of aircraft maneuvers at subsonic speeds as well as through the transonic and supersonic speed ranges. All this is to be accomplished at minimum cost, weight, and complexity. Some of the factors involved in the design are discussed. These include intake location, blunt cowl lips and their influence on incidence range; matching of engine flow demand with intake capacity; dynamic distortion measurement; and the control system for a variable intake. An assessment of the state of the art, research requirements, and possible technological advances is given. J.M.S.

N78-30111# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio. Turbine Engine Div.
ADVANCE NOZZLE TECHNOLOGY
Lawrence D. Wolfe and Arthur E. Fanning *In* AGARD Fighter Aircraft Design Jun. 1978 31 p (For primary document see N78-30099 21-05)
Avail: NTIS HC A13/MF A01

The exhaust concepts developed as design options for use on turbine engines which are to power advanced fighter aircraft are discussed with emphasis on nonaxisymmetric nozzle configurations. Nozzle performance, cooling effectiveness, and structural integrity at minimum weight are among the topics studied. Variations in thrust vector schedule, aircraft wing loading, and thrust loading are included. An example is used to illustrate the point that certain nonaxisymmetric nozzle and thrust vectoring schemes introduce an additional degree of complexity into the procedures necessary to properly account for the applied forces. J.M.S.

N78-30112# Societe Nationale d'Etudes et de Construction de Moteurs d'Aviation, Moissy-Cramayel (France).
STUDY OF A COMPROMISE BETWEEN THE COMPLEXITY OF A ROCKET ENGINE AND ITS COST [LA RECHERCHE D'UN COMPROMIS ENTRE LA COMPLEXITE D'UN MOTEUR DE CHASSEUR ET SON COUT]
J. F. Chevalier *In* AGARD Fighter Aircraft Design Jun. 1978 8 p In FRENCH (For primary document see N78-30099 21-05)
Avail: NTIS HC A13/MF A01

The cost of an aircraft is often related to takeoff weight or the complexity of the engine. The performance of the engine can reduce the weight of the aircraft and also the cost of the entire aircraft. These two aspects are discussed in detail. Aircraft weight and costs were calculated and the following missions were analyzed: (1) low altitude penetration; (2) tactical support; (3) aerial superiority; and (4) interception. Transl. by B.B.

N78-30113# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
IMPACT OF ACTIVE CONTROL ON STRUCTURES DESIGN
O. Sensburg and H. Zimmermann (Vereinigte Flugtechn. Werke-Fokker G.m.b.H., Bremen, West Ger.) *In* AGARD Fighter Aircraft Design Jun. 1978 26 p refs (For primary document see N78-30099 21-05)
Avail: NTIS HC A13/MF A01

A review of active control technologies is given with emphasis on fighter aircraft structures design. Artificial lateral stability, longitudinal stability, maneuver load control, and gust load alleviation are considered along with fatigue reduction, ride quality improvement, and active flutter suppression. J.M.S.

N78-30114# Departement Structures B. E. Aerospatiale, Toulouse (France).
NEW STRUCTURES MADE OF COMPOSITE MATERIALS FOR HIGH PERFORMANCE COMBAT AIRCRAFT [STRUCTURES NOUVELLES EN MATERIAUX COMPOSITES A HAUTES PERFORMANCES POUR AVIONS DE COMBAT]
Gilbert Correge *In* AGARD Fighter Aircraft Design Jun. 1978 18 p In FRENCH (For primary document see N78-30099 21-05)
Avail: NTIS HC A13/MF A01

Composite materials utilized in aircraft construction are described. Other areas of study are the following: (1) Types of composite structures utilized; (2) Materials; (3) Principles of local reinforcement; and (4) Protection against lightning strike. Transl. by B.B.

N78-30115# Hawker Siddeley Aviation Ltd., Kingston upon Thames (England).
METAL TECHNOLOGY FOR FUTURE AIRCRAFT DESIGN
Roger S. Dabbs *In* AGARD Fighter Aircraft Design Jun. 1978 16 p (For primary document see N78-30099 21-05)
Avail: NTIS HC A13/MF A01

Requirements of a material to be used for aircraft structures are discussed. These include: strength and stiffness, service life, vulnerability, repairability, inspectability, and cost effectiveness. Aluminum alloys, titanium alloys, and steels are among the metallic materials considered for application to future aircraft structures. The performance of metallic materials and graphite composites is compared. J.M.S.

N78-30116# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Dept. of Human Engineering.
DISPLAY SYSTEMS AND COCKPIT DESIGN
Ruediger Seifert and Hans Denkscherz *In* AGARD Fighter Aircraft Design Jun. 1978 11 p (For primary document see N78-30099 21-05)
Avail: NTIS HC A13/MF A01

A concept for a new cockpit design technology is presented. The need for a technology is dictated by the technical requirement for saving cockpit weight and space, resulting from the high g operations requirements, and from the operational requirement for limiting the quantitative personnel requirements. The basis for the technology is given by the present knowledge concerning the information processing capabilities of man, and by the empirical results of measurements of the time budget of man in man machine operations. From this the display and control modalities are derived, which ensure better utilization of the pilot's capabilities in the future fighter aircraft. This concept is considered to increase the system capacity of manned fighter aircraft, compared with the equipment overloaded aircraft of today. The principle allocation of the display and control function to the equipment and an example for the required characteristic for the functions in accordance to the time budget considerations are given. J.M.S.

N78-30117# Boeing Co., Seattle, Wash.
APPLICATION TECHNIQUES FOR DIGITAL FLIGHT CONTROL SYSTEMS
Donald L. Martin *In* AGARD Fighter Aircraft Design Jun. 1978 12 p refs (For primary document see N78-30099 21-05)
Avail: NTIS HC A13/MF A01

System design and implementation considerations in application of digital processing and signal transmission techniques to flight control systems are discussed. The digital flight control design cycle and both the overall similarity with analog implementation and the differences associated with software requirements specification are covered. Design problems that result from the digital processing are reviewed along with software development and testing at both the software and system development levels. The three channel redundant flight control computer used on the Boeing YC-14 advanced medium STOL transport is described along with advantages of digital applications. J.M.S.

N78-30118# British Aircraft Corp., Warton (England). Military Aircraft Div.
THE DESIGN OF A HIGH g COCKPIT
A. G. Barnes *In* AGARD Fighter Aircraft Design Jun. 1978 12 p refs (For primary document see N78-30099 21-05)
Avail: NTIS HC A13/MF A01

The physiological factors of operating under high g are discussed. The geometric aspects of reclining the pilot's seat, in order to achieve a measure of g alleviation, are illustrated. The implications of such a change with respect to displays and controls are considered along with techniques which offer solutions to the problems associated with displays and controls. Radical changes in cockpit layout are implied. J.M.S.

N78-30272 Aeronautical Research Labs., Melbourne (Australia).
SAFETY AGAINST FATIGUE IN FLIGHT: A PERSPECTIVE OF AUSTRALIAN EXPERIENCE AND RESEARCH
F. H. Hooke *In its* Aircraft Structural Fatigue Apr. 1977 p 5-22 refs (For primary document see N78-30271 21-31)
Copyright. Avail: Issuing Activity

N78-30274 Aeronautical Research Labs., Melbourne (Australia).
FRACTURE MECHANICS FUNDAMENTALS WITH REFERENCE TO AIRCRAFT STRUCTURAL APPLICATIONS
B. C. Hoskin *In its* Aircraft Structural Fatigue Apr. 1977 p 57-89 refs (For primary document see N78-30271 21-31)
Copyright. Avail: Issuing Activity

N78-30275 Aeronautical Research Labs., Melbourne (Australia).
FLIGHT LOAD RESEARCH AT ARL
A. K. Patterson and C. K. Rider *In its* Aircraft Structural Fatigue Apr. 1977 p 93-101 refs (For primary document see N78-30271 21-31)
Copyright. Avail: Issuing Activity

N78-30277 Aeronautical Research Labs., Melbourne (Australia).
DEVELOPMENT OF A LOAD SEQUENCE FOR A STRUCTURAL FATIGUE TEST
P. J. Howard *In its* Aircraft Structural Fatigue Apr. 1977 p 137-148 refs (For primary document see N78-30271 21-31)
Copyright. Avail: Issuing Activity

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N78-30119# Institute for Defense Analyses, Arlington, Va. Cost Analysis Group.
THE FEASIBILITY OF ESTIMATING AVIONICS SUPPORT COSTS EARLY IN THE ACQUISITION CYCLE. VOLUME 1: THE BASIC REPORT Final Report, 17 Jan. - Sep. 1977
John D. Morgan and Aaron B. Fuller Sep. 1977 248 p
(Contract DAHC15-73-C-0200)
(AD-A054016; AD-E500025; P-1292-Vol-1) Avail: NTIS HC A11/MF A01 CSCL 15/5

This paper reports on research to determine the feasibility of developing methods to estimate, early in the system acquisition cycle, the potential support cost inputs of alternative avionics components envisioned for Air Force and Navy fighter aircraft. Support costs are defined as those costs incurred at the organizational, intermediate and depot levels to maintain avionics equipment and the costs of avionics spares and repair parts support. The results of the study are presented in two volumes. Volume I reviews and evaluates current methods used in industry and in the Air Force and Navy to estimate these avionics support costs. Finally, the paper concludes that it is feasible and desirable to prepare these estimates for avionics support costs. The specific method to be adopted depends on the amount of resources OSD wishes to devote to this effort. Volume II is a compilation of appendixes containing additional material to support the basic report, including summary evaluations of forty-eight key documents encountered in the literature search. GRA

N78-30120# RCA Government and Commercial Systems, Burlington, Mass. Automated Systems Div.
HHSD DEMONSTRATION MODEL DEVELOPMENT Final Report, Sep. 1976 - Dec. 1977
G. T. Burton and B. R. Clay Dec. 1977 63 p
(Contract N62269-76-C-0390)
(AD-A054437) Avail: NTIS HC A04/MF A01 CSCL 01/4

This Final Report summarizes the status of the Holographic Horizontal Situation Display effort. This program's objective was the development and optimization of the techniques and hardware required to demonstrate a bright, high contrast, annotatable, multicolor display. Display hardware with a CRT, tape transport and source tapes were developed that demonstrate the characteristics of the focussed image holographic storage technique as applied to the annotated moving map display requirement of the HHSD application of the AIDS program. Author (GRA)

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N78-30121*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
SHORT-TERM PERFORMANCE DETERIORATION IN JT9D-7A(SP) ENGINE 695743
R. J. Bouchard, W. R. Beyerly, and G. P. Sallee 30 Jun. 1978 236 p
(Contract NAS3-20632)
(NASA-CR-135431; PWA-5512-17) Avail: NTIS HC A11/MF A01 CSCL 21E

The level of performance deterioration that occurred during early service was studied and also the contribution of each engine module to the overall level of engine performance deterioration. To assist in the distribution of the performance losses to the module level, testing with expanded experimental instrumentation was accomplished to permit direct measurement of module performance. An analytical teardown of the engine was accomplished to permit assignment of module performance losses to individual mechanical damage mechanisms including blade and seal wear, roughness, and thermal distortion of turbine parts. The results of the testing show that the engine deteriorated 1.5 percent in thrust specific fuel consumption from its performance when new. Initial testing, which included water washing, showed that 0.2 percent in performance deterioration was due to surface contamination (dirt) and 0.1 percent was due to drift of the engine vane control system, leaving 1.2 percent in basic TSFC deterioration. This 1.2 percent TSFC loss was distributed among the engine modules with 0.6 percent caused by clearance changes, 0.4 percent loss due to thermal distortion, and 0.2 percent loss due to increased roughness of the fan and low-pressure compressor airfoils. G.G.

N78-30122*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPUTER PROGRAM FOR THE DESIGN AND OFF-DESIGN PERFORMANCE OF TURBOJET AND TURBOFAN ENGINE CYCLES
Shelby J. Morris Jun. 1978 76 p refs
(NASA-TM-78653) Avail: NTIS HC A05/MF A01 CSCL 21E

The rapid computer program is designed to be run in a stand-alone mode or operated within a larger program. The computation is based on a simplified one-dimensional gas turbine cycle. Each component in the engine is modeled thermodynamically. The component efficiencies used in the thermodynamic modeling are scaled for the off-design conditions from input design point values using empirical trends which are included in the computer code. The engine cycle program is capable of producing reasonable engine performance prediction with a minimum of computer execute time. The current computer execute time on the IBM 360/67 for one Mach number, one altitude, and one power setting is about 0.1 seconds. about 0.1 seconds. The principal assumption used in the calculation is that the compressor is operated along a line of maximum adiabatic efficiency on the compressor map. The fluid properties are computed for the combustion mixture, but dissociation is not included. The procedure included in the program is only for the combustion of JP-4, methane, or hydrogen. G.G.

N78-30123*# McDonnell Aircraft Co., St. Louis, Mo.
F-15 INLET/ENGINE TEST TECHNIQUES AND DISTORTION METHODOLOGIES STUDIES. VOLUME 1: TECHNICAL DISCUSSION Final Report
C. H. Stevens, E. D. Spong, and M. S. Hammock Jun. 1978 248 p refs 9 Vol.
(Contract NAS4-2364)
(NASA-CR-144866) Avail: NTIS HC A11/MF A01 CSCL 21E

Peak distortion data taken from a subscale inlet model were studied to determine if the data can be used to predict peak distortion levels for a full scale flight test vehicle, and to provide a better understanding of the time variant total pressure distortion and the attendant effects of Reynolds number/scale and frequency content. The data base used to accomplish this goal covered a range from Mach 0.4 to 2.5 and an angle of attack range from -10 degrees to +12 degrees. Data are presented which show that: (1) increasing the Reynolds number increases total pressure recovery, decreases peak distortion, and decreases turbulence, (2) increasing the filter cutoff frequency increases both peak distortion and turbulence, and (3) the effect of engine presence on total pressure recovery, peak distortion, and turbulence is small but favorable. B.B.

N78-30124*# McDonnell Aircraft Co., St. Louis, Mo.
F-15 INLET/ENGINE TEST TECHNIQUES AND DISTORTION METHODOLOGIES STUDIES. VOLUME 2: TIME VARIANT DATA QUALITY ANALYSIS PLOTS Final Report
C. H. Stevens, E. D. Spong, and M. S. Hammock Jun. 1978 64 p 9 Vol.
(Contract NAS4-2364)
(NASA-CR-144867) Avail: NTIS HC A04/MF A01 CSCL 21E

Time variant data quality analysis plots were used to determine if peak distortion data taken from a subscale inlet model can be used to predict peak distortion levels for a full scale flight test vehicle. For abstract, see N78-30123. B.B.

N78-30125*# McDonnell Aircraft Co., St. Louis, Mo.
F-15 INLET/ENGINE TEST TECHNIQUES AND DISTORTION METHODOLOGIES STUDIES. VOLUME 3: POWER

SPECTRAL DENSITY PLOTS Final Report
C. H. Stevens, E. D. Spong, and M. S. Hammock Jun. 1978 103 p refs 9 Vol.
(Contract NAS4-2364)
(NASA-CR-144868) Avail: NTIS HC A06/MF A01 CSCL 21E

Power spectral density plots were used to determine if peak distortion data taken from a subscale inlet model can be used to predict peak distortion levels for a full scale flight test vehicle. For abstract, see N78-30123. B.B.

N78-30126*# McDonnell Aircraft Co., St. Louis, Mo.
F-15 INLET/ENGINE TEST TECHNIQUES AND DISTORTION METHODOLOGIES STUDIES. VOLUME 4: AUTOCORRELATION FUNCTIONS Final Report
C. H. Stevens, E. D. Spong, and M. S. Hammock Jun. 1978 99 p 9 Vol.
(Contract NAS4-2364)
(NASA-CR-144869) Avail: NTIS HC A05/MF A01 CSCL 21E

Autocorrelation function plots were used to determine if peak distortion data taken from a subscale inlet model can be used to predict peak distortion levels for a full scale flight test vehicle. For abstract, see N78-30123. B.B.

N78-30127*# McDonnell Aircraft Co., St. Louis, Mo.
F-15 INLET/ENGINE TEST TECHNIQUES AND DISTORTION METHODOLOGIES STUDIES. VOLUME 5: EFFECT OF FILTER CUTOFF FREQUENCY ON TURBULENCE PLOTS Final Report
C. H. Stevens, E. D. Spong, and M. S. Hammock Jun. 1978 103 p 9 Vol.
(Contract NAS4-2364)
(NASA-CR-144870) Avail: NTIS HC A06/MF A01 CSCL 21E

The effect of filter cutoff frequency on turbulence plots were used to determine if peak distortion data taken from a subscale inlet model can be used to predict peak distortion levels for a full scale flight test vehicle. For abstract, see N78-30123. B.B.

N78-30128*# McDonnell Aircraft Co., St. Louis, Mo.
F-15 INLET/ENGINE TEST TECHNIQUES AND DISTORTION METHODOLOGIES STUDIES. VOLUME 6: DISTORTION ANALYSIS PLOTS Final Report
C. H. Stevens, E. D. Spong, and M. S. Hammock Jun. 1978 1056 p 9 Vol.
(Contract NAS4-2364)
(NASA-CR-144871) Avail: NTIS HC A99/MF A01 CSCL 21E

Distortion analysis plots were used to determine if peak distortion data taken from a subscale inlet model can be used to predict peak distortion levels for a full scale flight test vehicle. For abstract, see N78-30123. B.B.

N78-30129*# McDonnell Aircraft Co., St. Louis, Mo.
F-15 INLET/ENGINE TEST TECHNIQUES AND DISTORTION METHODOLOGIES STUDIES. VOLUME 7: CROSS CORRELATION FUNCTIONS. Final Report
C. H. Stevens, E. D. Spong, and M. S. Hammock Jun. 1978 49 p 9 Vol.
(Contract NAS4-2364)
(NASA-CR-144872) Avail: NTIS HC A03/MF A01 CSCL 21E

Cross correlation function plots were used to determine if peak distortion data taken from a subscale inlet model can be used to predict peak distortion levels for a full scale flight test vehicle. For abstract, see N78-30123. B.B.

N78-30130*# McDonnell Aircraft Co., St. Louis, Mo.
F-15 INLET/ENGINE TEST TECHNIQUES AND DISTORTION METHODOLOGIES STUDIES. VOLUME 8: CROSS SPECTRAL DENSITY PLOTS Final Report
C. H. Stevens, E. D. Spong, and M. S. Hammock Jun. 1978 58 p 9 Vol.
(Contract NAS4-2364)
(NASA-CR-144873) Avail: NTIS HC A04/MF A01 CSCL 21E

Cross spectral density plots were used to determine if peak distortion data taken from a subscale inlet model can be used to predict peak distortion levels for a full scale flight test vehicle. For abstract, see N78-30123. B.B.

N78-30131*# McDonnell Aircraft Co., St. Louis, Mo.
F-15 INLET ENGINE TEST TECHNIQUES AND DISTORTION METHODOLOGIES STUDIES. VOLUME 9: STABILITY AUDITS Final Report
C. H. Stevens, E. D. Spong, and M. S. Hammock Jun. 1978 35 p 9 Vol.
(Contract NAS4-2364)
(NASA-CR-144874) Avail: NTIS HC A03/MF A01 CSCL 21E

Stability audit plots were used to determine if peak distortion data taken from a subscale inlet model can be used to predict peak distortion levels for a full scale flight test vehicle. For abstract, see N78-30123. B.B.

N78-30132# Purdue Univ., Lafayette, Ind.
PROJECT SQUID Semiannual Progress Report, 1 Oct. 1977 - 31 Mar. 1978
T. Adamson, F. Browand, E. Bruce, F. Carta, and R. Chang 1 Apr. 1978 93 p refs
(Contract N00014-75-C-1143)
(AD-A054100) Avail: NTIS HC A05/MF A01 CSCL 21/5

Reports of progress during the past six months on the 22 research programs comprising Project SQUID are presented. The research programs fall into the areas of Aerodynamics and Turbomachinery, Combustion and Chemical Kinetics, Measurements and Turbulance. Project SQUID is a cooperative program of basic research related to jet propulsion. It is administered by Purdue University and sponsored by the Office of Naval Research. Author (GRA)

N78-30133# Vought Corp., Dallas, Tex.
PRODUCTION/COST ANALYSIS OF RAMJET ENGINES, VOLUME 1 Final Technical Report, Apr. 1976 - Jun. 1977
Homer E. Reynolds Dec. 1977 134 p refs
(Contract F33615-76-C-2043)
(AD-A054856; AFAPL-TR-77-50-Vol-1) Avail: NTIS HC A07/MF A01 CSCL 21/5

The subject program was conducted for the purpose of generating cost information on ramjet engines and developing a methodology that could be employed to accurately predict production costs ramjet engines. The methodology addresses many different ramjet types, sizes and production quantities. The methodology determines the cost of individual modules of ramjet assemblies based on similarity of the modules to baseline components that are identified in a cost handbook. (There are typically around 20 basic components of a given ramjet to be costed.) The total cost of the engine is a summation of all the appropriate cost elements. A significant accomplishment of the program was the development of a large cost data base on many different configurations, materials of construction and variations in manufacturing processes. This data base should provide a good foundation on which to build other cost data as it becomes available. GRA

N78-30134# TRW, Inc., Cleveland, Ohio. Materials Technology.
RAPID CORE REMOVAL METHOD FOR HOLLOW DS EUTECTIC TURBINE BLADES Final Report, Jul. 1976 - Jul. 1977
T. Derkacs, P. N. Atanmo, L. Johnson, and T. S. Piwonka Dec. 1977 50 p refs
(Contract F33615-76-C-5330; Proj. ILIR-0083)
(AD-A054829; TRW-ER-7921-F; AFML-TR-77-207) Avail: NTIS HC A03/MF A01 CSCL 11/6

This report covers work performed in a program to develop a rapid core removal method for DS eutectic turbine blades. Fifteen candidate core materials were evaluated by sessile drop tests for chemical compatibility with a molten alloy of the NiTaC-13 composition minus rhenium. Based on the sessile drop test results and preliminary removability studies three candidate materials were selected for removability screening studies using ultrasonic energy in hot water, KOH and NaOH solutions. GRA

N78-30135# Imperial Coll. of Science and Technology, London (England). Mechanical Engineering Dept.

A 2D PARTIALLY-PARABOLIC PROCEDURE FOR AXIAL-FLOW TURBOMACHINERY CASCADES

A. K. Singhal and D. Brian Spalding Aeron. Res. Council 1978 35 p refs Supersedes ARC-37016

(ARC-R/M-3807; ARC-37016; BR61585) Avail: NTIS HC A03/MF A01; HMSO £4; PHI $15.30

A general finite-difference procedure is presented for the calculation of steady, two-dimensional partially-parabolic flows, with special reference to turbine cascade problems. It can be used for incompressible, subsonic, supersonic or transonic flows. It can be characterized as an iterative space-marching method. The method is more economical in computer storage than time-marching procedures; and computer time is also low. The main distinguishing features of the method are: 1) use of a streamline coordinate system, 2) one-dimensional storage for all variables except pressure, 3) solution by repeated marching integration from upstream to downstream. The capabilities of the method are demonstrated by application to six different inviscid-flow problems. In each case, computed results are compared with the available analytical or experimental data. Good agreement is shown. The method is capable of including momentum transfer across streamlines by viscous effects; it can easily incorporate a two-equation turbulence model; and heat transfer can be simultaneously calculated. Author (ESA)

N78-30136# Imperial Coll. of Science and Technology, London (England).

A PARAMETRIC COMPUTATION OF FLOWS AND PERFORMANCE OF ROTATING RADIAL DIFFUSERS

A. K. Majumdar and D. Brian Spalding Aeron. Res. Council 1978 49 p refs Supersedes ARC-37188

(Contract SRC-B/RG/6848/7)

(ARC-R/M-3810; ARC-37188) Avail: NTIS HC A03/MF A01; HMSO £5; PHI $19.20

A finite-difference procedure is employed to predict the three-dimensional turbulent flow in a rotating radial impeller. The flows are treated as partially parabolic and the turbulence phenomena are represented by a two-equation turbulence model involving the solution of two differential equations, one for the kinetic energy of turbulence and the other for its dissipation rate. Parametric computations have been performed to study: 1) the effect of rotation on three-dimensional flow pattern; and 2) the effect of geometrical and flow parameters on the performance of the impeller. Author (ESA)

N78-30137# Cambridge Univ. (England). Dept. of Engineering.

CASCADES WITH ARBITRARY END WALL CONTRACTION

R. Galapatti and W. R. Hawthorne London Aeron. Res. Council 1978 39 p refs Supersedes ARC-37077

(ARC-R/M-3813; ARC-37077) Avail: NTIS HC A03/MF A01; HMSO £4; PHI $15.30

A linearized theory for the steady flow of an incompressible, inviscid fluid through a linear cascade of airfoils set in a channel with contracting or expanding walls is developed first for uniform, potential, flow at inlet and then for a shear flow to represent thick boundary layers near the endwalls. The results are compared with earlier work in which the effects of endwall contraction or expansion are expressed in terms of the axial velocity ratio, i.e., the ratio of downstream and upstream axial velocities at mid-span, and it is shown that these earlier theories are in substantial error because they neglect the effect of the variation of circulation along the airfoils and the velocities induced by the trailing vortices. Experimental studies of a cascade of NACA 0012 symmetrical uncambered airfoils at a small deflection and pitch-chord ratio in a porous endwall tunnel, in a tunnel with contracting endwalls, and also with a substantially thickened endwall boundary layer are described and compared with the theory. Author (ESA)

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N78-30138*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AIRPLANE STABILITY CALCULATIONS WITH A CARD PROGRAMMABLE POCKET CALCULATOR

Windsor L. Sherman Aug. 1978 63 p refs

(NASA-TM-78678; L-12066) Avail: NTIS HC A04/MF A01 CSCL 01C

Programs are presented for calculating airplane stability characteristics with a card programmable pocket calculator. These calculations include eigenvalues of the characteristic equations of lateral and longitudinal motion as well as stability parameters such as the time to damp to one-half amplitude or the damping ratio. The effects of wind shear are included. Background information and the equations programmed are given. The programs are written for the International System of Units, the dimensional form of the stability derivatives, and stability axes. In addition to programs for stability calculations, an unusual and short program is included for the Euler transformation of coordinates used in airplane motions. The prgrams have been written for a Hewlett Packard HP-67 calculator. However, the use of this calculator does not constitute an endorsement of the product by the National Aeronautics and Space Administration. Author

N78-30139*# Virginia Polytechnic Inst. and State Univ., Blacksburg.

STRUCTURAL DYNAMICS, STABILITY, AND CONTROL OF HELICOPTERS

Leonard Meirovitch and Arthur L. Hale Jul. 1978 55 p refs (Grant NsG-1114)

(NASA-CR-158909) Avail: NTIS HC A04/MF A01 CSCL 01C

The dynamic synthesis of gyroscopic structures consisting of point-connected substructures is investigated. The objective is to develop a mathematical model capable of an adequate simulation of the modal characteristics of a helicopter using a minimum number of degrees of freedom. The basic approach is to regard the helicopter structure as an assemblage of flexible substructures. The variational equations for the perturbed motion about certain equilibrium solutions are derived. The discretized variational equations can be conveniently exhibited in matrix form, and a great deal of information about the system modal characteristics can be extracted from the coefficient matrices. The derivation of the variational equations requires a monumental amount of algebraic operations. To automate this task a symbolic manipulation program on a digital computer is developed.Author

N78-30140*# Boeing Aerospace Co., Kent, Wash.

APPLICABILITY OF THE CONTROL CONFIGURED DESIGN APPROACH TO ADVANCED EARTH ORBITAL TRANSPORTATION SYSTEMS Final Report

Andrew K. Hepler, Howard Zeck, William H. Walker, and Daniel E. Shafer Aug. 1978 104 p refs

(Contract NAS1-14833)

(NASA-CR-2723) Avail: NTIS HC A06/MF A01 CSCL 01C

The applicability of the control configured design approach (CCV) to advanced earth orbital transportation systems was studied. The baseline system investigated was fully reusable vertical take-off/horizontal landing single-stage-to-orbit vehicle and had mission requirements similar to the space shuttle orbiter. Technical analyses were made to determine aerodynamic, flight control and subsystem design characteristics. Figures of merit were assessed on vehicle dry weight and orbital payload. The results indicated that the major parameters for CCV designs are hypersonic trim, aft center of gravity, and control surface heating. Optimized CCV designs can be controllable and provide substantial payload gains over conventional non-CCV design vertical take-off vehicles. S.B.S.

N78-30141*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SIMULATION STUDY OF THE OSCILLATORY LONGITUDINAL MOTION OF AN AIRPLANE AT THE STALL
William H. Phillips Aug. 1978 43 p refs
(NASA-TP-1242; L-12064) Avail: NTIS HC A03/MF A01 CSCL 01C

Hybrid simulation of the longitudinal motion of a straight-wing airplane at the stall was studied to investigate the effect of hysteresis in the development of lift and pitching moments on the wing as a function of angle of attack on the occurrence of longitudinal oscillaticns at the stall. Flight data for the simulated airplane and for various other airplanes are shown for the simulated airplane and for comparison. The results show that oscillations similar to those measured in flight may be obtained by incorporating hysteresis in the lift and pitching-moment curves. S.B.S.

N78-30142# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
EXPERIMENTAL INVESTIGATION OF GUST RESPONSE OF HINGELESS HELICOPTER ROTORS M.S. Thesis
Charles A. Vehlow Jun. 1977 105 p refs
(AD-A054752) Avail: NTIS HC A06/MF A01 CSCL 01/3

The response to wind gusts of a 1/10-scale hingeless helicopter rotor model in hovering and forward flight is studied experimentally through wind tunnel testing. The experimental program involving design, construction, and testing of a five-foot-diameter rotor utilizing either three NACA 0012 planform blades or one operable blade with two dummy blades is described. The rotor design is such that the torsional stiffness of the blade assembly as well as the blade chordwise center-of-gravity location can be varied during the various phases of the test. Wind tunnel testing incorporates the variation of wind tunnel speed and the application of variable frequency, sinusoidal waveform gusts. The flap, lag, and torsional response of the rotor in its various configurations was measured and compared with theoretical predictions. Author (GRA)

N78-30143# Royal Aircraft Establishment, Farnborough (England). Flight Systems Dept.
A PYRAMID SKEWED AXIS SENSOR SET FOR MULTIPLEX FLIGHT CONTROL SYSTEMS
D. Kimberley London Aeron. Res. Council 1978 35 p refs Supersedes RAE-TR-75055; ARC-36355
(ARC-R/M-3808; BR61586; RAE-TR-75055; ARC-36355) Avail: NTIS HC A03/MF A01; HMSO £4; PHI $15.30

In order to meet the two defect survival capability in future full-time flight control systems, one approach is to use four identical sensors in each axis, giving a total of twelve for a three-axis system. An alternative eight sensor pyramid arrangement has been developed which offers a similar two defect survival capability in all three axes leading to reduced cost and maintenance effort but with slightly larger transients following failure of a sensor. The pyramid arrangement can also be used for fail safe systems reducing the number of sensors from six to four, or alternatively for a twelve gyro, four defect survival configuration. Author (ESA)

N78-30276 Aeronautical Research Labs., Melbourne (Australia).
GUST MEASUREMENTS AND THE N SUB o PROBLEM
Douglas John Sherman *In its* Aircraft Structural Fatigue Apr. 1977 p 103-135 refs (For primary document see N78-30271 21-31)
Copyright. Avail: Issuing Activity

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N78-30144*# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
SELF STREAMLINING WIND TUNNEL: FURTHER LOW SPEED TESTING AND FINAL DESIGN STUDIES FOR THE TRANSONIC FACILITY
S. W. D. Wolf Jun. 1978 37 p refs
(Grant NsG-7172)
(NASA-CR-158900) Avail: NTIS HC A03/MF A01 CSCL 14B

Work was continued with the low speed self streamlining wind tunnel (SSWT) using the NACA 0012-64 airfoil in an effort to explain the discrepancies between the NASA Langley low turbulence pressure tunnel (LTPT) and SSWT results obtained with the airfoil stalled. Conventional wind tunnel corrections were applied to straight wall SSWT airfoil data, to illustrate the inadequacy of standard correction techniques in circumstances of high blockage. Also one SSWT test was re-run at different air speeds to investigate the effects of such changes (perhaps through changes in Reynold's number and freestream turbulence levels) on airfoil data and wall contours. Mechanical design analyses for the transonic self-streamlining wind tunnel (TSWT) were completed by the application of theoretical airfoil flow field data to the elastic beam and streamline analysis. The control system for the transonic facility, which will eventually allow on-line computer operation of the wind tunnel, was outlined. B.B.

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N78-30145* National Aeronautics and Space Administration, Washington, D. C.
SPACE AGENCY NOTES 20TH ANNIVERSARY
Robert A. Frosch Oct. 1978 104 p Submitted for publication
(NASA-News-Release-78-133; P78-10141) Avail: NASA Scientific and Technical Information Facility, P. O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22A

The twentieth anniversary of NASA is announced. A chronology of major milestones of the NASA program is given along with a brief outline of the programs and responsibilities of NASA Headquarters and the NASA centers and facilities. The NASA launch record is included. J.M.S.

N78-30146*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACELAB MISSION 1 EXPERIMENT DESCRIPTIONS
Paul D Craven, ed. May 1978 154 p
(NASA-TM-78173; ESA/FSLP-EX-001) Avail: NTIS HC A08/MF A01 CSCL 22A

Brief descriptions of experiments and facilities planned for Spacelab I are presented. These experiments and facilities were selected from the responses to the Announcement of Opportunity for the first Spacelab mission. These experiments are grouped under the topics of: atmospheric physics and earth observations, space plasma physics, material sciences and technology, astronomy and solar physics, and life sciences. S.B.S.

N78-30147*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE ROLE OF ROBOTS AND AUTOMATION IN SPACE
Ewald Heer 1 Sep. 1978 43 p refs
(Contract NAS7-100)
(NASA-CR-157560; JPL-Pub-78-78) Avail: NTIS HC A03/MF A01 CSCL 22A

Advanced space transportation systems based on the shuttle and interim upper stage will open the way to the use of large-scale industrial and commercial systems in space. The role of robot and automation technology in the cost-effective implementation and operation of such systems in the next two decades is discussed. Planning studies initiated by NASA are described as applied to space exploration, global services, and space industrialization, and a forecast of potential missions in each category is presented. The appendix lists highlights of space robot technology from 1967 to the present. Author

N78-30148# Committee on Science and Technology (U. S. House).
PANEL DISCUSSIONS ON INTERNATIONAL SPACE ACTIVITIES

Washington GPO 1978 169 p refs Hearings before Subcomm. on Space Sci. and Applications of the Comm. on Sci. and Technol. 95th Congr., 2d Sess., 20-21 Jun. 1978
(GPO-31-888) Avail: Subcomm. on Space Sci. and Applications

Panelists were called to examine and evaluate the international implications of U.S. space activities and interaction with other notions. The economic and technical issues of international cooperative activities as well as the content of such activities are explored. This will help determine how best to plan for the societal benefits for world-wide space activities. G.Y.

N78-30149*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NASA/ESA CV-990 SPACELAB SIMULATION (ASSESS 2)
Jul. 1977 47 p Prepared in cooperation with ESA, Paris
(NASA-TM-79748) Avail: NTIS HC A03/MF A01 CSCL 22A

Cost effective techniques for addressing management and operational activities on Spacelab were identified and analyzed during a ten day NASA-ESA cooperative mission with payload and flight responsibilities handled by the organization assigned for early Spacelabs. Topics discussed include: (1) management concepts and interface relationships; (2) experiment selection; (3) hardware development; (4) payload integration and checkout; (5) selection and training of mission specialists and payload specialists; (6) mission control center/payload operations control center interactions with ground and flight problems; (7) real time interaction during flight between principal investigators and the mission specialist/payload specialist flight crew; and (8) retrieval of scientific data and its analysis. A.R.H.

N78-30150*# California Univ., Berkeley. Space Sciences Lab.
EXPERIMENT DEFINITION AND INTEGRATION STUDY FOR THE ACCOMMODATION OF MAGNETIC SPECTROMETER PAYLOAD ON SPACELAB/SHUTTLE MISSIONS Final Report, 13 Jun. 1977 - 1 Jul. 1978
Andrew Buffington 1 Jul. 1978 56 p refs
(Contract NAS5-24165)
(NASA-CR-156806; SSL-Ser-19-Issue-45) Avail: NTIS HC A04/MF A01 CSCL 22A

A super-cooled magnetic spectrometer for a cosmic-ray experiment is considered for application in the high energy astronomical observatory which may be used on a space shuttle spacelab mission. New cryostat parameters are reported which are appropriate to shuttle mission weight and mission duration constraints. Since a super-conducting magnetic spectrometer has a magnetic fringe field, methods for shielding sensitive electronic and mechanical components on nearby experiments are described. G.G.

N78-30832# Joint Publications Research Service, Arlington, Va.
TENTATIVE ASSESSMENT OF 1977 COSMOS PROGRAM PROVIDED
Didier Laurent *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 46 (JPRS-71727) 22 Aug. 1978 p 45-60 Transl. into ENGLISH from Aeronaut. Astronaut. (Paris), no. 3, 1978 p 37-44 (For primary document see N78-30827 21-59)
Avail: NTIS HC A05/MF A01

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N78-30151# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
OPTIMAL ESCAPE TRAJECTORY FROM A HIGH EARTH ORBIT BY USE OF SOLAR RADIATION PRESSURE M.S. Thesis
Andrew Joseph Green 8 Aug. 1977 106 p refs
(AD-A054754; T-652) Avail: NTIS HC A06/MF A01 CSCL 22/3

This thesis develops the optimal control law necessary for a minimum time escape from a high Earth orbit utilizing solar radiation pressure. A force model is developed for an ideal flat sail and a proposed Jet Propulsion Laboratory square sail. A two-body inverse square force field model is assumed. The Earth's orbit about the Sun is assumed circular, and the solar flux is assumed constant during the escape maneuver. The initial state is given, and the only condition on the final state is that the energy of the spececraft equals zero. A modified Newton-Raphson method is used to solve the two-point boundary value problem. It is found that the performance of any solar sail escape trajectory tends to fall between the limiting cases of similar polar and ecliptic escape trajectories. A velocity-dependent control law is also examined and found to be a good approximation to the optimal control law. Author (GRA)

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

N78-30152*# Lockheed Missiles and Space Co., Huntsville, Ala.
ENVIRONMENT AND TEST SPECIFICATION LEVELS GROUND SUPPORT EQUIPMENT FOR SPACE SHUTTLE SYSTEM LAUNCH COMPLEX 39. VOLUME 2: THERMAL AND PRESSURE. PART 1: HEATING RATES, PRESSURE LOADS, AND PLUME FLOW FIELDS
Peter R. Sulyma, Robert E. Carter, Beverly Audeh, and Sheldon D. Smith 1 Jul. 1977 393 p refs
(NASA-CR-157611; GP-1059-Vol-2-Pt-1) Avail: NTIS CSCL 22D

The launch-induced plume impingement thermal and pressure environment on selected parts of Launch Complex 39 during the ascent of the space shuttle vehicle are predicted. The SSME and SRM flow fields are described and the theoretical models used to predict the heating rates and pressure loads experienced by LC 39 during a space shuttle vehicle launch are discussed. A simplified technique is included for calculating LC 39 thermal and pressure environments for points of interest or other ascent trajectories not considered in this study. The heating rate and pressure load predictive values presented are intended to assist designers in evaluating adequacy of existing specifications, to indicate areas where redesign may be considered desirable, and to provide a basis for future selection of hardware, support equipment and structures located in critical areas on the launch complex. A.R.H.

N78-30153*# Lockheed Missiles and Space Co., Huntsville, Ala.
ENVIRONMENT AND TEST SPECIFICATION LEVELS GROUND SUPPORT EQUIPMENT FOR SPACE SHUTTLE SYSTEM LAUNCH COMPLEX 39. VOLUME 2: THERMAL AND PRESSURE. PART 2: SPECIFIC TEMPERATURES OF SELECTED PARTS OF LC-39
Peter R. Sulyma Cocoa Beach, Fla. NASA. Kennedy Space Center 1 Jul. 1977 142 p refs
(NASA-CR-157612; GP-1059-Vol-2-Pt-2) Avail: NTIS HC A07/MF A01 CSCL 22D

The results of a study to predict the plume heating thermal structural response of selected parts of Launch Complex 39 during the ascent of the Space Shuttle vehicle is presented. A brief description of the heat conduction equations used and the numerical method selected for their solution is given as well as material property data used in the analysis to represent each of the components of LC 39. B.B.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N78-30154* National Aeronautics and Space Administration, Washington, D. C.
FIRST IN NEW ENVIRONMENTAL SPACECRAFT SERIES TO BE LAUNCHED
5 Sep. 1978 23 p
(NASA-News-Release-78-132; P78-10139) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22A

A series of operational meteorological monitoring satellites (TIROS-N) is described. Emphasis is placed on environmental monitoring instruments onboard the satellites that provide technological advances over previous sensors. Benefits in the areas of weather forecasting, oceanography, water resource management, and flood forecasting are discussed along with the operational capability to collect and transmit environmental data from platforms on land, at sea, and airborne, and to track stations motion. The participation of Canada, Great Britain, and France is mentioned and a description of the launch vehicle is included. J.M.S.

N78-30155*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
AN ATLAS OF GEOS-3 RADAR ALTIMETER DATA FOR DATA BUOY COMPARISON STUDIES
H. Ray Stanley and Ronald L. Taylor (EG and G/Analytical Services Center, Pocomoke City, Md.) Aug. 1978 113 p
(Contract NAS6-2639)
(NASA-TM-73276) Avail: NTIS HC A06/MF A01 CSCL 22A

An atlas is compiled to identify times and dates when GEOS-3 altimeter data was taken in the vicinity of data buoys. The time period covered is from GEOS launch to April 9, 1978. Two buffer areas are considered for each of the various buoy locations to determine the simultaneity of GEOS and buoy data. The two buffer areas are ± or - 0.25 degrees and ± or - 1 degree. Author

N78-30156*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SUMMARY OF VOYAGER DESIGN AND FLIGHT LOADS
J. C. Chen, J. A. Garba, and F. D. Day, III 1 Sep. 1978 42 p refs
(Contract NAS7-100)
(NASA-CR-157566; JPL-Pub-78-74) Avail: NTIS HC A03/MF A01 CSCL 22B

Estimates of flight loads for Voyager 1 and Voyager 2 are summarized and compared to the Voyager design loads obtained from the shock spectra/impedance method and to the loads obtained using space vehicle transient loads analysis. These estimates were obtained by using the measured flight accelerations at the launch vehicle/spacecraft interface as forcing functions for the Voyager mathematical model. Based on these data, an assessment of the shock spectra/impedance loads method used for Voyager is presented. The following conclusions were reached: (1) the shock spectra approach provided reasonable conservative design loads for Voyager, (2) care has to be executed to insure that all critical events are accounted for in constructing shock spectra envelopes, (3) the selection of critical events is not always obvious, especially for those flight events wherein the spacecraft dynamic characteristics are important, and (4) the success of the method is strongly dependent on the analysts' experience and judgement. S.B.S.

N78-30157*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LUNAR TRANSIENT PHENOMENA CATALOG
Winifred Sawtell Cameron Jul. 1978 109 p refs
(NASA-TM-79399; NSSDC/WDC-A-R/S-78-03) Avail: NTIS HC A06/MF A01 CSCL 22A

This catalog lists 1468 descriptions of observed lunar transient phenomena reported in the literature. J.M.S.

N78-30158*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LAUNCH SUMMARY FOR 1973 - 1977
Robert W. Vostreys May 1978 113 p refs
(NASA-TM-79398; NSSDC/WDC-A-R/S-78-02) Avail: NTIS HC A06/MF A01 CSCL 22A

A summary listing launches of sounding rockets, artificial earth satellies, and space probes between January 1, 1973 and December 31, 1977 is presented. B.B.

N78-30159*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CATALOG OF VIKING MISSION DATA
Robert W. Vostreys, ed. May 1978 41 p
(NASA-TM-79397; NSSDC/WDC-A-R/S-78-01) Avail: NTIS HC A03/MF A01 CSCL 22A

This catalog announces the present/expected availability of scientific data acquired by the Viking missions and contains descriptions of the Viking spacecraft, experiments, and data sets. An index is included listing the team leaders and team members for the experiments. Information on NSSDC facilities and ordering procedures, and a list of acronyms and abbreviations are included in the appendices. A.R.H.

N78-30160# Naval Air Test Center, Patuxent River, Md.
TESTING OF THE TOW MISSILE-CONFIGURED AH-1T HELICOPTER
Daniel G. Cash 15 May 1978 8 p refs
(AD-A054297; NATC-TM-78-3-RW) Avail: NTIS HC A02/MF A01 CSCL 01/3

Navy flight testing of the Tube-Launched, Optically-Tracked, Wire-Guided (TOW) missile on the AH-1T helicopter was conducted during the Navy Service Acceptance Trials in February and March 1977. Twenty-six TOW missiles, along with 2.75 inch rockets and 20mm ammunition, were fired during this evaluation at the Army's Yuma Proving Ground. This technical memorandum deals with the preparation and conduct of the trials. Author (GRA)

N78-30161# Armament Development and Test Center, Eglin AFB, Fla.
THREE DIMENSIONAL TRANSONIC MODEL TESTING ON A ROCKET SLED TRACK Final Report
Daniel J. Krupovage Jan. 1978 57 p refs
(AD-A054831; ADTC-TR-78-8) Avail: NTIS HC A04/MF A01 CSCL 16/4

This report presents the results of several rocket sled runs which were conducted on the Holloman High Speed Test Track facility. The objective of these runs was to collect aerodynamic and vibratory data on a rocket test sled which was specifically designed to test large three dimensional models at Mach numbers up to 1.5. The vehicle design emphasizes aerodynamic cleanliness and minimum frontal area while attempting to incorporate maximum stiffness in order to provide a relatively rigid testing platform in an undisturbed transonic flow field. Flow angularity measurements were made by three different methods. One method used pressure data obtained from a five hole direction probe, another used pressure data measured on a wing-body model which had been previously tested in wind tunnels, and the third method determined flow field angularity from model sting strain gage data. Mach number was calculated in two ways: from electro-optical space-time measurements and also using dynamic pressure readings. Author (GRA)

N78-30162# Centre National d'Etudes Spatiales, Toulouse (France).
MICROCALORIMETRIC EXPERIMENT ONBOARD THE SRET 2 SATELLITE [EXPERIENCE MICROCALORIMETRE DU SATELLITE SRET 2]
Jacques Simon Oct. 1977 17 p refs In FRENCH; ENGLISH summary
(CNES-NT-76) Avail: NTIS HC A02/MF A01

A calorimetric experiment for measuring solar absorptance degradation of selected thermal control coating was flown aboard the French satellite launched into an elliptical orbit on June 5, 1975. Three test samples (white and aluminum paints) and one reference surface (black paint) were involved. The calorimetric

experiment and the preliminary flight results after the first two years in orbit are described. Author (ESA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N78-30163*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SPACE SHUTTLE ORBITER TRIMMED CENTER-OF-GRAVITY EXTENSION STUDY. VOLUME 6: SYSTEM DESIGN STUDIES
Ian O. MacConochie Aug. 1978 36 p refs
(NASA-TM-72661) Avail: NTIS HC A03/MF A01 CSCL 22B

System studies were made to determine the required changes in shuttle orbiter mass for various changes in aerodynamic shape. These changes are designed to extend the current shuttle orbiter trimmed c.g. envelope to accommodate a greater range of payloads. One of the apparently most viable changes for the amount of c.g. extension obtained involves the removal of the present wing/body fillet and the replacement of this structural element with a forward located fixed canard. Author

N78-30164*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TECHNIQUES FOR THE DETERMINATION OF MASS PROPERTIES OF EARTH-TO-ORBIT TRANSPORTATION SYSTEMS Interim Technical Information Release
Ian O. MacConochie and Phillip J. Klich Jun. 1978 104 p refs
(NASA-TM-78661) Avail: NTIS HC A06/MF A01 CSCL 22A

One estimating technique involves trending whereby projections of overall mass properties of vehicles are determined with few inputs. The second technique involves trending of individual subsystems using equations of the form KXN to the nth power or KX. Some constants and exponentials are provided for sample subsystems. Mass properties are reported in a format recommended by mil spec - 38310. G.G.

N78-30165*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SRB MATERIALS AND PROCESSES ASSESSMENT FROM LABORATORY AND OCEAN ENVIRONMENTAL TESTS
Jun. 1978 221 p
(NASA-TM-78187) Avail: NTIS HC A10/MF A01 CSCL 22B

The Materials and Processes Laboratory evaluation of Solid Rocket Boosters (SRB) and Solid Rocket Motors (SRM) candidate material, both in-house and with ocean exposure tests at Panama City and Kennedy Space Center (KSC), Florida is presented. Early sample tests showed excellent seawater corrosion resistance for inconel 718 and titanium 6A1-4V alloys. Considerable corrosion and biofouling occurred with bare 2219-T87 aluminum. Subsequent tests conclusively demonstrated that epoxy coatings prevented corrosion of 2219-T87 aluminum as long as the coatings stays intact. The results and assessment of the series of ocean environmental tests that were conducted are also presented. S.E.S.

N78-30166*# Boeing Aerospace Co., Seattle, Wash.
TECHNOLOGY REQUIREMENTS FOR ADVANCED EARTH ORBITAL TRANSPORTATION SYSTEMS. VOLUME 2: SUMMARY REPORT Final Report
A. K. Hepler and E. L. Bangsund Jul. 1978 199 p
(Contract NAS1-13944)
(NASA-CR-2879; D180-19168-4-Vol-2) Avail: NTIS HC A09/MF A01 CSCL 22A

The results of efforts to identify the technology requirements for advanced earth orbital transportation systems are reported. Topics discussed include: (1) design and definition of performance potential of vehicle systems, (2) advanced technology assessment, and (3) extended performance. It is concluded that the horizontal take-off concept is the most feasible system considered. S.E.S.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

N78-30167# Naval Research Lab., Washington, D. C. Space Science Div.
SOLRAD 11: EXPERIMENT TIMING, TELEMETRY AND COMMAND SUMMARY Interim Report
D. M. Horan, B. W. Kreplin, K. P. Dere, and C. Y. Johnson Apr. 1978 100 p
(AD-A054635; AD-E000158; NRL-MR-3754) Avail: NTIS HC A05/MF A01 CSCL 09/6

Detailed information on the command, telemetry and data sampling sequences associated with each experiment aboard the SOLRAD 11 satellites is presented so that telemetered information can be properly interpreted. Information for interpreting telemetry from the satellites orientation sensors is presented so that the locations of sources of experiment data can be determined. It is assumed that the reader has a complete knowledge of the design and operation of the experiments. Author (GRA)

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics.*

N78-30168*# Martin Marietta Corp., Denver, Colo.
STRUCTURAL ATTACHMENTS FOR LARGE SPACE STRUCTURES. TASK 1 REPORT: DEVELOPMENT OF ATTACHMENT CONCEPTS Final Report
W. R. Britton, R. A. Spencer, and M. D. Thulson Jul. 1978 82 p
(Contract NAS8-32654)
(NASA-CR-150773; MCR-78-596) Avail: NTIS HC A05/MF A01 CSCL 22B

Methodology and results are reported from the concept development study on structural attachments for large space structures. Key elements of each structure were identified in tabular form. These data were used to develop joint angles, beam elements used, size of structure, and to provide information of available construction support equipment. Attachment methods for constructing rectangular, trapezoidal, and tetrahedral large structures were also identified. G.G.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

N78-30169*# Old Dominion Univ., Norfolk, Va. School of Engineering.
NONLINEAR ANALYSIS AND PERFORMANCE EVALUATION OF THE ANNULAR SUSPENSION AND POINTING SYSTEM (ASPS) Final Report
Suresh M. Joshi Aug. 1978 62 p refs
(Grant NsG-1241)
(NASA-CR-3040) Avail: NTIS HC A04/MF A01 CSCL 22B

The Annular Suspension and Pointing System (ASPS) can

provide high accurate fine pointing for a variety of solar-, stellar-, and Earth-viewing scientific instruments during space shuttle orbital missions. In this report, a detailed nonlinear mathematical model is developed for the ASPS/Space Shuttle system. The equations are augmented with nonlinear models of components such as magnetic actuators and gimbal torquers. Control systems and payload attitude state estimators are designed in order to obtain satisfactory pointing performance, and statistical pointing performance is predicted in the presence of measurement noise and disturbances. Author

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N78-30170# Hercules, Inc., Wilmington, Del. Systems Group.
STUDY OF STRUCTURAL DAMPING IN SOLID PROPELLANT ROCKET MOTORS UNDERGOING UNSTABLE ACOUSTIC OSCILLATIONS Final Report, Apr. 1976 - Jun. 1977
F. R. Jesen Dec. 1977 163 p refs
(Contract F04611-76-C-0039)
(AD-A054152; AFRPL-TR-77-84) Avail: NTIS HC A08/MF A01 CSCL 21/8

The objective of the program was to establish the role of structural damping regulating acoustic pressure growth rates in solid-propellant rocket motors and to show the accuracy to which structural damping calculations can be made. The planned approach called for testing to be conducted on subscale rocket motors to provide data for verification of analysis results. Because of various technical problems experienced in the testing task, the program objectives were not achieved. For example, a test configuration that yields accurate acoustic natural frequencies and mode shapes was found to be entirely inadequate for damping measurements. This problem, which was ultimately found to be the major problem with the experimental task, was traced to an unwanted acoustic coupling between the driver cavity and the main acoustic cavity in the test model. In spite of the problems, the coverage of the testing task given in this report should be of interest to anyone planning to measure structural dampening of acoustic modes in rocket motors. GRA

N78-30171# Los Alamos Scientific Lab., N. Mex.
STATISTICAL ANALYSIS AND PLANNING OF MULTIHUNDRED-WATT IMPACT TESTS
H. F. Martz, Jr. and M. S. Waterman Oct. 1977 16 p refs
(Contract W-7405-eng-36)
(LA-6886-MS) Avail: NTIS HC A02/MF A01

Modular multihundred watt (MHW) radioisotope thermoelectric generators (RTG's) were used as a power source for spacecraft. Due to possible environmental contamination by radioactive materials, numerous tests were required to determine and verify the safety of the RTG. There are results available from 27 fueled MHW impact tests regarding hoop failure, fingerprint failure, and fuel failure. Data from the 27 tests were statistically analyzed for relationships that exist between the test design variables and the failure types. Next, these relationships were used to develop a statistical procedure for planning and conducting MHW impact tests or similar tests on other RTG fuel sources. ERA

N78-30172# Royal Aircraft Establishment, Farnborough (England). Space Dept.
THE UK ION THRUSTER SYSTEM AND A PROPOSED FUTURE PROGRAMME
May 1977 196 p refs
(RAE-TR-77063; BR60117) Avail: NTIS HC A09/MF A01

The technology of the UK's mercury ion thruster system and its development and performance status in May 1976 are described. A detailed program for developing the complete system for operational use in 1983 is proposed. Author (ESA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N78-30173# Stanford Univ., Calif. Dept. of Computer Science.
DENDRAL AND META-DENDRAL: THEIR APPLICATIONS DIMENSION
Bruce G. Buchanan and Edward A. Feigenbaum Feb. 1978 28 p refs
(Contract MDA903-77-C-0322)
(AD-A054289; SU-STAN-CS-78-649; SU-HPP-78-1) Avail: NTIS HC A03/MF A01 CSCL 07/3

The DENDRAL and Meta-DENDRAL programs assist chemists with data interpretation problems. The design of each program is described in the context of the chemical inference problems the program solves. Some chemical results produced by the programs are mentioned. Author (GRA)

N78-30174# Battelle Columbus Labs., Ohio.
DEVELOPMENT OF MIL-HDBK-5 DESIGN ALLOWABLE PROPERTIES AND FATIGUE-CRACK PROPAGATION DATA FOR SEVERAL AEROSPACE MATERIALS Final Report, 31 Jan. 1975 - 30 Jun. 1977
Paul E. Ruff and Samuel H. Smith Wright-Patterson AFB, Ohio AFML Oct. 1977 308 p refs
(Contract F33615-75-C-5063; AF Proj. 7381)
(AD-A054430; AFML-TR-77-162) Avail: NTIS HC A14/MF A01 CSCL 11/6

This final report describes a test program to determine certain missing MIL-HDBK-5 design allowable properties for 17-4PH bar, 15-5PH bar, and Alloy 188 sheet and to develop low stress intensity fatigue-crack-propagation data for 7075-T7351, 7475-T7351, and 2124-T851 plate. Author (GRA)

N78-30175# Ames Lab., Iowa.
KINETICS AND MECHANISM OF DEALKYLATION OF THE ALKYL-BRIDGED DIMETALLIC COBALOXIMES AND THE ACID DECOMPOSITION OF HYDRIDOCOBALOXIME M.S. Thesis
Tai-Hsiang Chao Oct. 1977 103 p refs
(Contract W-7405-eng-82)
(IS-T-774) Avail: NTIS HC A06/MF A01

The reaction of the excess tributylphosphine-cobaloxime complex with 1,4-dibromobutane forms, in succession, 4-bromobutyl cobalozime and a 1,4-butenyl dicobaloxime. This dimetallic alkylbridged organocobaloxime undergoes successive dealkylation reaction with Hg(2+)/sub aq/. The organocobaloxime also undergo protonation equilibria at oxime oxygen position. Quantitative studies of the rates and equilibria of these reactions are reported, along with data for the comparison complex n-butylcobaloxime. The forward rate of the reaction 2HCo(Hdmg)2 P(n-C4H9)3 = H2 + 2Co(Hdmg)2P(n-C4H9)3 was determined in methanol water solutions as a function of perchloric acid concentration, 0.003-0.10 M. The reaction proceeds by two parallel pathways, with respective first-order and second-order dependences upon the concentration of hydridocobaloxime. ERA

N78-30176# Sandia Labs., Albuquerque, N. Mex.
MATERIALS PROBLEMS IN SOLAR, NUCLEAR, AND STORAGE OF ENERGY
R. S. Claassen 1978 29 p Presented at the 5th Energy Technol. Conf., Washington, D. C., 27 Feb. 1978
(Contract EY-76-C-04-0789)
(SAND-78-0354C) Avail: NTIS HC A03/MF A01

Developing energy technologies place increasing demand on material performance and in some cases exceed known material capabilities. Material choices in solar energy systems are dominated by cost. Distributed collectors and the central receiver illustrate practical problems. The demand for absolute safety in nuclear power requires a depth of understanding and level of

knowledge about materials unachieved in previous engineering systems. Problems in water-cooled and breeder reactors emphasize the point. Fusion reactors will push far beyond our present knowledge of material response and behavior. Within limits, energy storage is practical today but present technologies such as batteries are being pushed hard and new schemes such as superconducting solenoids and thermochemical storage are under intense study. ERA

24 COMPOSITE MATERIALS

Includes laminates.

N78-30177 California Univ., San Diego.
ON MIXTURE THEORIES FOR DIFFUSION AND WAVE PROPAGATION IN COMPOSITE MATERIALS Ph.D. Thesis
Hidenori Murakami 1978 226 p
Avail: Univ. Microfilms Order No. 7810577

The development of mixture theories with microstructure is described for thermal diffusion and wave propagation in binary fibrous composites with periodic microstructure. The model presented is closed in a sense that mixture constitutive relations are derived systematically based upon a knowledge of the geometry and constitutive relations for the individual constituents. Model construction is based upon a regular asymptotic scheme wherein the ratio of transverse-to-longitudinal characteristics times associated with a physical process is assumed to be small. The model retains considerable information regarding the diffusion of mechanical fields within the microstructure. Dissert. Abstr.

N78-30178*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MODIFIED COMPOSITE MATERIALS WORKSHOP
Dennis L. Dicus, comp. Jul. 1978 355 p Workshop held at Langley Research Center, Hampton, Va., 23-24 Mar. 1978
(NASA-TM-78761) Avail: NTIS HC A16/MF A01 CSCL 11D

The reduction or elimination of the hazard which results from accidental release of graphite fibers from composite materials was studied at a workshop. At the workshop, groups were organized to consider six topics: epoxy modifications, epoxy replacement, fiber modifications, fiber coatings and new fibers, hybrids, and fiber release testing. Because of the time required to develop a new material and acquire a design data base, most of the workers concluded that a modified composite material would require about four to five years of development and testing before it could be applied to aircraft structures. The hybrid working group considered that some hybrid composites which reduce the risk of accidental fiber release might be put into service over the near term. The fiber release testing working group recommended a coordinated effort to define a suitable laboratory test. S.B.S.

N78-30179# National Mechanical Engineering Research Inst., Pretoria (South Africa). Aeronautics Research Unit.
INVESTIGATION INTO THE USE OF COMPOSITE MATERIALS FOR ROTORCRAFT ROTORS Ph.D. Thesis
M. S. Hunt Oct. 1977 275 p refs
(CSIR-ME-1533; Ser-MEL/228; Ref-MEL/5402) Avail: NTIS HC A12/MF A01

The suitability of composite materials is considered from the point of view of both the design and the manufacture of rotor blades for autogyros or helicopters. The investigation showed that glass fiber, resin and structural foam can be used to produce high quality blades having strength properties greatly superior to those which were obtained with any conventional high duty structural material. The high structural quality of the blades was demonstrated by a series of laboratory tests in which blade specimens were tested to destruction to determine their strength and mode of failure. The unusually high reserve factors obtained showed good agreement with predictions. In the flight test program the output from a number of strain gauges mounted on the rotor blades was transmitted by a telemetry system mounted on the rotor itself. The recorded results showed good agreement with theoretical predictions. G.G.

N78-30180# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
ADHESIVE BONDED STEEL: BOND DURABILITY AS RELATED TO SELECTED SURFACE TREATMENTS
A. T. Devine Dec. 1977 43 p refs
(AD-A053944; AD-E400050; ARLOD-TR-77027) Avail: NTIS HC A03/MF A01 CSCL 13/8

High-strength 4340 carbon steel single lap-shear coupons were treated with four selected surface preparations: (1) wire brush, (2) sodium metasilicate/ Triton X-200 solution, (3) phosphoric acid/ethanol solution, and (4) potassium iodide/ phosphoric acid iodophosphate solution. Bonded joints were made with all four surface preparations using 3 M's EC 2214 epoxy and B. F. Goodrich's TAME 200 acrylic adhesive. The joints were subjected to lap shear strength-control testing at 23 C and 60 C, then to hot water soak at 60 C for 100, 500, and 1,000 hours followed by testing at 60 C and stressed durability at 60 C and 95% RH until failure. Results indicate only slight differences in control test results for the different surface treatments using EC 2214, but very large differences using TAME 200. Durability of joints using both adhesives clearly favors the iodophosphate and phosphoric acid/ethanol treatmens. Author (GRA)

N78-30181# General Atomic Co., San Diego, Calif.
EFFECT OF STEAM OXIDATION ON THE STRENGTH AND ELASTIC MODULUS OF GRAPHITE H-451
C. Velasquez, W. Johnson, G. Hightower, and R. Burnette Dec. 1977 56 p refs
(Contract EY-76-C-03-0167-017)
(GA-A-14657) Avail: NTIS HC A04/MF A01

Graphite grade H-451, the reference material used as fuel and reflector elements in high-temperature gas-cooled reactors, was oxidized to 20% burnoff by weight in steam helium mixtures, and the effects of oxidation on ultimate tensile strength (UTS) and elastic modulus (E) were studied. Large numbers of small cylindrical samples cored from selected locations in a log of preproduction H-451 graphite were oxidized at 1073 and 1273K in helium containing 3% water vapor and 5% H2. The UTS and E of oxidized specimens were measured and the results compared with those for nonoxidized control specimens. The average rate of change of UTS and E with burnoff at 1273 K (up to 20% burnoff)averaged 3.6% and 5.2%, respectively. Statistical analysis of the low burnoff strength data showed no significant differences between the monoxidized control and oxidized specimens at burnoffs of up to approximately 2%. ERA

N78-30182# California Univ., Livermore. Lawrence Livermore Lab.
ROTOR DESIGN IMPLICATIONS FOR COMPOSITE MATERIAL PROPERTIES
R. H. Toland 25 Oct. 1977 7 p Presented at the Flywheel Technol. Symp., San Francisco, 5-7 Oct. 1977
(Contract W-7405-eng-48)
(UCRL-80117; Conf-771053-8) Avail: NTIS HC A02/MF A01

The role and needs of materials research and characterization are defined within the context of the rotor design and analysis process. In particular, material/geometry tailoring permits design optimization. Composites can be utilized most efficiently when fiber properties govern rotor performance and reliability. Time-dependent properties are essential for practical and reliable rotor design. ERA

N78-30183# Propellants, Explosives and Rocket Motor Establishment, Waltham Abbey (England).
A RELIABLE METHOD FOR DETERMINING THE DENSITY OF COMPOSITE MATERIALS
J. M. Burgess Nov. 1977 12 p refs
(PERME-Memo-8; BR603231) Avail: NTIS HC A02/MF A01

A range of calibrated density liquids based on zinc chloride for the determination of fibrous composite densities is described together with the apparatus. The method is accurate, convenient to use, and has good long term stability. Author (ESA)

N78-30288 Aeronautical Research Labs., Melbourne (Australia).
FIBRE COMPOSITE REINFORCEMENT OF CRACKED AIRCRAFT STRUCTURES

A. A. Baker and M. M. Hutchison *In its* Aircraft Structural Fatigue Apr. 1977 p 419-457 refs (For primary document see N78-30271 21-31)
Copyright. Avail: Issuing Activity

N78-30311# General Electric Co., Fairfield, Conn.
HEAT EXCHANGER MATERIALS BASED ON LITHIUM AND MAGNESIUM ALUMINUM SILICATES
Louis R. McCreight *In* DOE Highway Vehicle Systems Mar. 1978 p 224-225 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

N78-30312# Owens-Illinois, Inc., Toledo, Ohio.
IMPROVED HEAT EXCHANGER MATERIALS
Kenneth Kormanyos *In* DOE Highway Vehicle Systems Mar. 1978 p 225-238 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

N78-30313# Corning Glass Works, N.Y.
ALUMINOUS KEATITE AS A REGENERATOR MATERIAL (GUEST PRESENTATION)
John G. Lanning *In* DOE Highway Vehicle Systems Mar. 1978 p 238-240 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N78-30184 Michigan State Univ., East Lansing.
AN EMISSION SPECTROCHEMICAL DETECTOR FOR CHROMATOGRAPHY Ph.D. Thesis
Robert Knight Lantz 1977 190 p
Avail: Univ. Microfilms Order No. 7810081

A spark emission spectrochemical detector (SED) was developed and evaluated for gas and liquid chromatography. A low energy, high power, miniature coaxial spark discharge is used to atomize and excite analytes to produce characteristic atomic emissions. Time-resolved photometric measurement of the light emitted from the spark allows the isolation, in time, of the desired emission signals from the background continuum. Continuous, element-specific analysis of chromatographic effluents is demonstrated for carbon, hydrogen, oxygen, boron, nitrogen, sulfur, silicon, and phosphorus and for most metals. Only the alkali metals, iron, and the halogens had detection limits worse than 1 microgram. Amenable elements are detected to the nanogram and picogram levels, and detector response is linear over 1000 to 10 to the 8th power fold concentration changes for all elements studied. Dissert. Abstr.

N78-30185 Michigan State Univ., East Lansing.
KINETICS STUDIES OF ION TRANSPORT THROUGH LIPID BILAYER MEMBRANES Ph.D. Thesis
Thomas Allen Last 1977 166 p
Avail: Univ. Microfilms Order No. 7810082

The kinetics of ion transport, through glycerol monooleate/n-hexadecane membranes, induced by the actin homologs (monactin and dinactin) were studied using the charge injection technique. Both time dependent and steady state measurements were performed of the transport system. The mechanism for the macrotetralide induced ion transport through the membranes was found to be adequately described by the carrier model. Transients recorded at 10 MHz recording rate showed one early relaxation which was due to the rapid (voltage related) increase in the complex molecule translocation rate constant. The rate limiting step for steady state ion transport was found to be the free carrier translocation process. The surface complexation reaction was found to maintain essentially equilibrium conditions at all times except during the early relaxation. Dissert. Abstr.

N78-30186 California Univ., Berkeley.
PHOTOEMISSION STUDIES OF CLEAN AND ADSORBATE COVERED METAL SURFACES USING SYNCHROTRON AND UV RADIATION SOURCES Ph.D. Thesis
Gustav Richard Apai, II 1977 122 p
Avail: Univ. Microfilms Order No. 7812474

Photoemission energy distribution experiments on clean metal and adsorbate covered surfaces were performed under ultrahigh vacuum conditions using X-ray and ultraviolet photon sources in the laboratory as well as continuously tunable, highly polarized synchrotron radiation. Studies were focused on two general areas: (1) Cross-section modulation in the photoemission process was studied, as a function of photon energy and orbital composition. Sharp decreases in intensity of the valence bands of several transition metals (i.e., Ag, Au, and Pt) were attributed to the radial nodes in the respective wave functions. (2) Adsorbate photoemission studies of CO adsorbed on platinum single crystals have demonstrated a very high spectral sensitivity. Angle-resolved photoemission has allowed us to determine the orientation of CO chemisorbed on a Pt(111) or Ni(111) surface. Dissert. Abstr.

N78-30187 California Univ., Berkeley.
SEMICLASSICAL METHODS FOR NONSEPARABLE SYSTEMS Ph.D. Thesis
Bruce Campbell Garrett 1977 193 p
Avail: Univ. Microfilms Order No. 78-12568

Semiclassical techniques were widely used for describing the dynamics of molecular collisions. The calculation of discrete energy eigenvalue spectra in bound systems has also employed semiclassical methods, a well known example being the Bohr-Sommerfeld quantum condition for a one-dimensional potential well. Work was done towards developing semiclassical theories for rate constants in reactive systems and semiclassical eigenvalues in bound systems. Application of these theories were made to nonseparable multidimensional systems. Transition state theory has played an important role in chemical kinetics and is very useful for approximating rate constants for molecular systems. Many shortcomings of transition state theory can be attributed to the assumption of separability of motion along the reaction coordinate which is inherent in traditional formulations of the theory. Dissert. Abstr.

N78-30188 Wyoming Univ., Laramie.
A MASS SPECTROSCOPIC INVESTIGATION OF SOME BIOLOGICALLY SIGNIFICANT FRACTIONS OF AN AMERICAN PETROLEUM Ph.D. Thesis
Frank David Guffey 1977 217 p
Avail: Univ. Microfilms Order No. 78-11694

Four saturated hydrocarbon fractions were investigated, using combined gas chromatography-mass spectroscopy. The saturated hydrocarbon material from a sample representing the 450 to 475 C distillate cut of the Wilmington oil was obtained by adsorption chromatography on silica gel. This material was further separated by gel permeation chromatography before the combined gas chromatography-mass spectroscopy investigations were undertaken. Three isoprenoid alkanes, seven steranes, and seven pentacyclic triterpanes were identified in these fractions. Three of the steranes were tentatively identified as the 5 alpha, 14 beta isometers of cholestane, ergostane and stigmastane. These isomers have not been noted in other fossil fuel sources. The presence of several other compounds that may be biomarkers is inferred. Dissert. Abstr.

N78-30189 Purdue Univ., Lafayette, Ind.
A PATTERN RECOGNITION APPROACH TO THE INTERPRETATION AND CHARACTERIZATION OF MASS SPECTRAL AND ELECTROANALYTICAL DATA Ph.D. Thesis
David Russell Burgard 1977 230 p
Avail: Univ. Microfilms Order No. 7813034

The characterization of the information contained in the low resolution, electron impact mass spectra of intact oligodeoxyribonucleotides is described. Reproducible differences in the mass spectra of the sixteen commonly occurring dincleotides were found. Features were useful for the identification of nucleosides present as well as a semi-quantitative estimate of the relative numbers of the nucleosides in a particular DNA fragment. The characterization of staircase voltammetric data from electroactive organic compounds is also described. The data base included

the voltammograms obtained from thirty different organic compounds representing four different skeleton/electroactive group combinations. The four combinations were: aeromatic-nitro, aliphatic-nitro, aromatic-aldehyde and aromatic-aliphatic-ketones. Dissert. Abstr.

N78-30190 Oregon State Univ., Corvallis.
VIBRATIONAL AND REORIENTATIONAL LIFETIMES IN LIQUIDS DETERMINED BY RAMAN SPECTROSCOPY Ph.D. Thesis
Larry Gene Morgan 1978 344 p
Avail: Univ. Microfilms Order No. 78-11989

Studies of anisotropic and isotropic Raman line shape yield information about the rotational motion (rotational correlation function) and non-reorientational (vibrational) lifetimes. The rotational motion of carbon disulfide was previously studied. This work was undertaken because the v sub 1 vibrational mode consist of numerous components including several isotropic components. The isotropic spectrum was analyzed and ten such components were found in the v sub 1 band and these were considered in analyzing the anisotropic spectrum. The Raman spectra of the 2 v sub 2 region and the Raman forbidden v sub 2 mode were also studied. The effects of finite collection aperture were investigated, compared to existing literature and studied experimentally for the v sub 1 mode of CCl4. Dissert. Abstr.

N78-30191 Stanford Univ., Calif.
PHOTODETACHMENT OF ELECTRONS FROM POLYATOMIC RADICAL ANIONS Ph.D. Thesis
Hamlin Lee McPeters 1978 178 p
Avail: Univ. Microfilms Order No. 78-14190

The photodetachment of electrons from radical anions of eleven stable molecules were investigated. The photodetachment cross sections were measured through the use of ion cyclotron resonance techniques together with a broadband light source or a tunable dye laser. Endothermic reactions and photodissociation of chlorine molecular anion below the thermodynamic light were observed. The relative photodetachment cross sections were determined for a number of ions: cyclooctatetraenyl anion, perinaphthenyl anion, p-benzoquinone anion, o-benzoquinone anion, 1,4-naphthoquinone anion, nitrobenzene anion, fumaronitrile anion, maleonitrile anion, vinylidene cyanide anion, tetracyanoethylene anion, and sulfur dioxide radical anion. Two groups of isomers, the benzoquinone and the dicyanoethylene anions were investigated for differences in their photodetachment spectra. Dissert. Abstr.

N78-30192 California Univ., Berkeley.
STUDIES OF ENERGY TRANSFER PROCESSES IN TRIPLET STATES USING OPTICALLY DETECTED MAGNETIC RESONANCE Ph.D. Thesis
Mark Thomas Lewellyn 1977 82 p
Avail: Univ. Microfilms Order No. 7812656

The techniques of both continuous wave and pulsed-coherent optically detected magnetic resonance spectroscopy were used to study energy transfer processes in the lowest triplet states of two aromatic molecular crystals. Of particular interest were the effects of crystal dimensionality and isotopic trap states on the efficiency of the transfer process in these systems. The relationship between the exciton band-to-band microwave transition lineshape of a one-dimensional crystal and the properties of coherent exciton migration is developed and discussed in terms of coherent exciton trapping experiments on isotopically-mixed single crystals of 1,2,4,5-tetrachlorobenzene (TCB). The dimensionality of energy transfer in pyrimidine single crystals is discussed in terms of previously reported experimental data. Optical and optically detected magnetic resonance experiments on isotopically-mixed pyrimidine single crystals are reported. Dissert. Abstr.

N78-30193# Ames Lab., Iowa.
MULTIELEMENT FLAME EMISSION SPECTROSCOPY USING A SCANNING FABRY-PEROT INTERFEROMETER M.S. Thesis
Gary Albert Korra Apr. 1978 89 p refs
(Contract W-7405-eng-82)
(IS-T-803) Avail: NTIS HC A05/MF A01

A system for multielement flame emission analysis based on a scanning Fabry-Perot interferometer is described and evaluated. Detection limits and linearity of response for ten elements commonly determined by flame photometry compare favorably to conventional single-element methods. Several elements in tap water, serum, urine, NBS SRM 1571 orchard leaves and low alloy steel to demonstrate the excellent accuracy and precision of the technique were analyzed. Resolution of the system allows up to five elements to be determined simultaneously. ERA

N78-30194# California Univ., Livermore. Lawrence Livermore Lab.
AIR-WATER SYNTHESIS OF AMMONIUM NITRATE
R. G. Garza, R. G. Hickman, and P. C. Souers Oct. 1977 6 p refs Presented at Alternative Energy Sources Symp., Miami Beach, Fla., 5 Dec. 1977
(Contract W-7405-eng-48)
(UCRL-79895; Conf-771203-2) Avail: NTIS HC A02/MF A01

For over a hundred years, researchers have infrequently sought to force air and water up the 300 kJ/mol thermodynamic mountain to form ammonium nitrate and nitrite fertilizer. Radiation, sound, catalysis, and discharges have all been tried, with yields of 0.1 to 50 ppM. Although small, these yields show that the reaction proceeds far more easily than expected. A systematic study to discover the best initiators and mechanisms has never been carried out. It is important, also, to devise better ways of mixing the physically dissimilar reactants than by mutual solubility. This reaction is important because the fertilizer's hydrogen comes from water and not from currently used natural gas. ERA

N78-30195# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Chemistry.
A FULLY AUTOMATED SYSTEM FOR PULSED NMR MEASUREMENTS Ph.D. Thesis
David Milton Cantor 1977 148 p refs
(Grants AF-AFOSR-3185-77; NSF MPS-19428)
(COO-1198-1203) Avail: NTIS HC A07/MF A01

The basic concepts in pulsed NMR experiments are discussed and details of the hardware interface between the computer and the NMR instrument are described. Design features, justification of the choices made between the many alternative design strategies, and details of the implementation of design goals are presented. Certain software features, common to all of the available experiments, are also discussed. Optimization of pulse lengths and phases is performed via a sequential search technique called Uniplex, which is described in detail. Other possible optimization strategies, and the reasons for choosing Uniplex, are discussed. Details of the implementation of the automated measurement of the spin-lattice relaxation time spin-span relaxation and diffusion constants are then presented. Sources of error are discussed, and ways in which errors may be recognized and eliminated are given. ERA

N78-30196# Battelle Memorial Inst., Geneva (Switzerland).
HYDROGENATION BY MEANS OF METAL HYDRIDES REGENERATED ELECTROLYTICALLY [HYDROGENATION AU MOYEN D'HYDRURES METALLIQUES ELECTROREGENERABLES]
F. Breda, P. Jonville, and D. Umpleby Dec. 1976 23 p In FRENCH; ENGLISH summary
Avail: NTIS HC A02/MF A01

The use of gaseous hydrogen or nonrecyclable reducing agents presents several disadvantages in current hydrogenation processes. In order to overcome these disadvantages, reagents are required that transfer their hydrogen directly to the hydrogenable substrate and can be regenerated without the need for a hydrogen atmosphere. This concept becomes possible by the use of certain metal alloys that reversibly form hydrides via electrolytic extraction of hydrogen from water and has been demonstrated for the hydrogenation of acetylene in laboratory tests. Extremely pure hydrogen which never appears in the gaseous form, yields that approach the theoretical, and simplification of downstream purification are the major advantages of this process. It may be applied to the hydrogenation of numerous functional groups and presents an interest to various branches of chemical industry. Author (ESA)

N78-30197# Oxford Univ. (England). Engineering Lab.
CONSIDERATION OF THE FLUORESCENCE FILM THICKNESS TECHNIQUE
B. J. Azzopardi Feb. 1978 21 p refs
(OUEL-1229/78) Avail: NTIS HC A02/MF A01

A fluorescence technique for film thickness measurement in solutions of suitable dyes is presented. The phenomena controlling the fluorescence response were identified and quantified. A model was derived which can adequately predict the film thickness/response relationship for the fluorescence film thickness technique. The disadvantages of the fluorescence technique and suggestions for their rectification are discussed. The double ray technique of Schwandon is critically examined. Author (ESA)

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N78-30198 Illinois Univ. at Urbana-Champaign, Urbana.
CRYSTALLOGRAPHY OF SHEAR TRANSFORMATIONS IN ZIRCONIUM HYDRIDES Ph.D. Thesis
Michael Philip Cassidy 1978 152 p
Avail: Univ. Microfilms Order No. 7811216

The crystallography of the shear transformations from delta to gamma and epsilon zirconium hydrides was studied. The habit planes, orientation relationships, lattice invariant shears, and interface structures were determined by transmission electron microscopy and diffraction. Surface tilts were observed and measured by interface microscopy. The direction and magnitude of the shape strain produced by the formation of gamma hydride were determined by the measurement of fiducial scratch displacements. Good agreement between the predictions of the theory and the measured crystallography were obtained for the gamma formed from the delta hydride if some prior hydrogen diffusion was assumed. Good agreement between the predictions of the theory and the measured crystallography for the delta to epsilon hydride transformation was obtained using published lattice parameters. Dissert. Abstr.

N78-30199 Florida Univ., Gainesville.
USE OF THE DIFFERENTIAL REFLECTOMETER IN THE STUDY OF THIN FILM CORROSION PRODUCTS ON COPPER Ph.D. Thesis
Charles William Shanley 1977 145 p
Avail: Univ. Microfilms Order No. 7810982

Thin film corrosion products were grown on copper substrates. Characteristic spectra for the copper oxides Cu2O and CuO were obtained, and were used to help define the boundaries of the regions of stability of the copper-water Pourbaix diagram. In addition, the evolution with time of a Cu2O film was monitored in SITU. It was established that in the thickness range of passive and semipassive films (d = 0 to 200 A) differential reflectometry produces a unique spectrum for each corrosion product, and that the intensity of the structure in the differential reflectogram is related to the thickness of the film. A method is described for calculating the differential reflectograms of thin film corrosion products for various film thicknesses if the optical constants of the film and substrate are known. Dissert. Abstr.

N78-30200 Alabama Univ., University.
THE INHIBITION OF METALLIC CORROSION: STRESS CORROSION CRACKING OF TYPE 304 STAINLESS STEEL IN BOILING AQUEOUS ACID CHLORIDE SOLUTIONS Ph.D. Thesis
Charles Stanley ODell 1978 150 p
Avail: Univ. Microfilms Order No. 7811964

A standard environment of 4N NaCl at 100 C with pH 2.3 produced intergranular stress corrosion cracking of Type 304 stainless steel U-bends in less than 24 hours. The additives NaI, SnCl2, SnCl4, FeCl, SnSO4, DcI2, and n-butylamine prevented stress corrosion cracking for the standard evaluation period (600 hours). All of these substances permit either pitting and/or general corrosion except for CdSO4. Cd(++) when added as CdCl2 was only moderately effective: also SO4(--) when added as Na2SO4 was only slightly effective. However, CdSO4 produced a synergistic effect preventing all forms of corrosion. The CdSO4 stopped both crack initiation and crack growth. Energy dispersive X-ray analysis shows high concentrations of S, Cd, Cl, and Cr within the inactive cracks. The mechanism of the control over stress corrosion cracking evidenced with CdSO4 is explained by reference to the complex ion theory of corrosion. Dissert. Abstr.

N78-30201 Illinois Inst. of Tech., Chicago.
CHEMI-IONIZATION OF METALS WITH ATOMIC OXYGEN Ph.D. Thesis
Peter Gregory Majeres 1977 144 p
Avail: Univ. Microfilms Order No. 7811818

The relative rates of the associative ionization reactions of the group 3A, 4B, 5B and rare earth metals with atomic oxygen were measured. The reactions were studied in a cross atomic beam apparatus using phase sensitive mass spectrometry to identify the products. By measuring the relative chemi-ion signals due to each of the different species in the metal beam, and the relative number densities of each metal species in the scattering region, it was possible to calculate the relative rates of the respective chemi-ionization reactions. The results show that rates for these reactions span a range of five magnitude. Reactions of selected metals with atomic and molecular chlorine were also studied. Classical curve crossing models for these processes are discussed. Dissert. Abstr.

N78-30202*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CORROSION INHIBITORS FOR SOLAR HEATING AND COOLING SYSTEMS
T. S. Humphries Aug. 1978 15 p refs
(NASA-TM-78180) Avail: NTIS HC A02/MF A01 CSCL 07D

Inhibitors which appeared promising in previous tests and additional inhibitors including several proprietary products were evaluated. Evaluation of the inhibitors was based on corrosion protection afforded an aluminum-mild steel-copper-stainless steel assembly in a hot corrosive water. Of the inhibitors tested two were found to be effective and show promise for protecting multimetallic solar heating systems. S.B.S.

N78-30203*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
AUTOMATIC WELDING OF STAINLESS STEEL TUBING
William E. Clautice Aug. 1978 151 p
(NASA-TM-79759; TR-1626) Avail: NTIS HC A08/MF A01 CSCL 11F

The use of automatic welding for making girth welds in stainless steel tubing was investigated as well as the reduction in fabrication costs resulting from the elimination of radiographic inspection. Test methodology, materials, and techniques are discussed, and data sheets for individual tests are included. Process variables studied include welding amperes, revolutions per minute, and shielding gas flow. Strip chart recordings, as a definitive method of insuring weld quality, are studied. Test results, determined by both radiographic and visual inspection, are presented and indicate that once optimum welding procedures for specific sizes of tubing are established, and the welding machine operations are certified, then the automatic tube welding process produces good quality welds repeatedly, with a high degree of reliability. Revised specifications for welding tubing using the automatic process and weld visual inspection requirements at the Kennedy Space Center are enumerated. A.R.H.

N78-30204# Paris-Sud Univ., Orsay (France).
QUANTITATIVE DETERMINATION OF CRYSTALLOGRAPHIC TEXTURES OF THIN PLATES: RELATIONS WITH MAGNETOCRYSTALLINE ANISOTROPY OF EXTRA SOFT STEELS AND ANISOTROPIC PLASTIC BEHAVIOR OF VARIOUS METALS AND ALLOYS OF CUBIC NETWORKS Ph.D. Thesis [DETERMINATION QUANTITATIVE DES TEXTURES CRISTALLOGRAPHIQUES DE TOLES MINCES: RELATIONS AVEC L'ANISOTROPIE MAGNETOCRISTALLINE D'ACIERS EXTRA-DOUX ET L'ANISOTROPIE DE COMPORTEMENT PLASTIQUE DE DIVERS METAUX ET ALLIAGES DE RESEAU CUBIQUE]
Michel Pernot 1977 183 p refs In FRENCH
Avail: NTIS HC A09/MF A01

The relationships between the texture of a polycrystalline

material and the anisotropy of the physical properties were studied. A quantitative description of crystallographic texture is given. Measurements were made on various types of samples using X-ray and neutron diffraction and calculation methods were developed for predicting anisotropic plastic deformation.
Transl. by B. B.

N78-30205*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SIMULATION MODEL OF A SINGLE-STAGE LITHIUM BROMIDE-WATER ABSORPTION COOLING UNIT
David Miao Aug. 1978 44 p refs
(NASA-TP-1296; E-9547) Avail: NTIS HC A03/MF A01 CSCL 20K

A computer model of a LiBr-H2O single-stage absorption machine was developed. The model, utilizing a given set of design data such as water-flow rates and inlet or outlet temperatures of these flow rates but without knowing the interior characteristics of the machine (heat transfer rates and surface areas), can be used to predict or simulate off-design performance. Results from 130 off-design cases for a given commercial machine agree with the published data within 2 percent. Author

N78-30206*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF OXYGEN, METHYL MERCAPTAN, AND METHYL CHLORIDE ON FRICTION BEHAVIOR OF COPPER-IRON CONTACTS
Donald H. Buckley Aug. 1978 19 p refs
(NASA-TP-1309; E-9606) Avail: NTIS HC A02/MF A01 CSCL 11F

Sliding friction experiments were conducted with an iron rider on a copper disk and a copper rider on an iron disk. The sputter cleaned iron and copper disk surfaces were saturated with oxygen, methyl mercaptan, and methyl chloride at atmospheric pressure. Auger emission spectroscopy was used to monitor the surfaces. Lower friction was obtained in all experiments with the copper rider sliding on the iron disk than when the couple was reversed. For both iron and copper disks, methyl mercaptan gave the best surface coverage and was most effective in reducing friction. For both iron and copper disks, methyl chloride was the least effective in reducing friction. With sliding, copper transferred to iron and iron to copper. Author

N78-30207# Naval Research Lab., Washington, D. C. Thermostructural Materials Branch.
EFFECT OF HEAT TREATMENT ON HIGH TEMPERATURE CRACK GROWTH UNDER STATIC LOAD IN ALLOY 718
Kuttimaddi Sadananda and Paul Shahinian Feb. 1978 26 p refs
(RR0240341)
(AD-A053848; AD-E000144; NRL-MR-3727) Avail: NTIS HC A03/MF A01 CSCL 11/6

Alloy 718 in its conventional heat treated form possesses very poor resistance to crack growth under static load in the temperature range of 425 to 760 C. Since this crack growth is found to be sensitive to the microstructure, a detailed investigation of the effect of heat treatment on the crack growth behavior has been made and various heat treatments have been evaluated with respect to their resistance to this crack growth. Among the heat treatments evaluated it is shown that solution at 926 C for 10 hours and age at 734 C for 48 hours would significantly improve the crack growth resistance without sacrificing its tensile properties. This improved resistance is attributed to the formation of N13 Cb precipitates which effectively strengthen the grain boundaries. Author (GRA)

N78-30208# Kawecki Berylco Industries, Inc., Reading, Pa.
BERYLLIUM-TITANIUM MATERIALS OPTIMIZATION PROGRAM Final Report, 28 May 1976 - 28 Dec. 1977
George H. Keith 17 Mar. 1978 38 p
(Contract N00019-76-C-0355)
(AD-A054278; R-BT-378) Avail: NTIS HC A03/MF A01 CSCL 11/4

Be/Ti alloy composites were developed having high tensile yield strength/proportional limit (greater than or equal to 40 ksi), 28,000,000 psi modulus and 3.32 g/cc density. Composite rods containing 133 and 259 filaments were tested containing filaments made from four grades of beryllium: P-1, HIP 50, HIP 70, and NP 40. The best combination of tensile yield strength/proportional limit and ductility was achieved using NIP 70 beryllium. GRA

N78-30209# Lockheed-California Co., Burbank.
EXPLORATORY DEVELOPMENT STUDIES FOR SUSTAINED LOAD SUBCRITICAL CRACK GROWTH IN TITANIUM ALLOYS Final Technical Report, Apr. 1976 - Jun. 1977
D. E. Pettit Aug. 1977 193 p refs
(Contract F33615-76-C-5168; AF Proj. 7351)
(AD-A054270; LR-28181; AFML-TR-77-143) Avail: NTIS HC A09/MF A01 CSCL 11/6

The following conclusions seem appropriate: The internal hydrogen level of a titanium alloy may increase the sustained load cracking behavior of the material; The extent of this degradation is dependent upon the microstructure, environment and, possibly, short range order. Other submicrostructural features may also be involved; Materials with an alpha - beta microstructure seem to show a greater susceptibility to sustained load cracking and hydrogen level than do the beta processed materials; As the thickness and associated triaxial constraint decrease, the tendency to exhibit sustained load cracking in high humidity air and dry argon decrease for Ti-6Al-4V(RA) with a high hydrogen content; Crystallographic texture in the Ti-6Al-4V (RA) does not appear to exhibit a major influence on sustained load cracking in high humidity air or dry argon but does exhibit a major effect in 3 1/2% NaCl solution. Great care must be exercised in assessing sustained load cracking behavior of Ti alloys since crack tip branching can result in crack arrest at a level much above that level where extensive sustained load cracking occurs. GRA

N78-30210*# National Materials Advisory Board, Washington, D. C.
RESPONSE OF METALS OF METALLIC STRUCTURES TO DYNAMIC LOADING Final Report
May 1978 188 p refs Sponsored by NASA
(Contract MDA903-78-C-0038)
(NASA-CR-156952; AD-A054267; NMAB-341) Avail: NTIS HC A09/MF A01 CSCL 20/11

Dynamic response of metals and metallic structures is reviewed with respect to current procedures and understanding in order to identify research needs. Emphasis is placed on response in military environments which involve very high loading rates, such as those due to air blasts and underwater explosions. Included in this review is discussion of basic inelastic deformation mechanisms, mechanical properties, fracture analysis and testing, structural analysis (including consideration of buckling response) and scale modeling. GRA

N78-30211# RCA Labs., Princeton, N. J.
BASIC ADHESION MECHANISMS IN THICK AND THIN FILMS Final Report, 1 Jan. - 31 Dec. 1977
Kenneth R. Bube and Thomas T. Hitch Mar. 1978 115 p refs
(Contract N00019-77-C-0176)
(AD-A054269; PRRL-78-CR-5) Avail: NTIS HC A06/MF A01 CSCL 11/6

This report is the fourth and final one in a series pertaining to the identification of factors which influence thick-film metallization adhesion. Prior work was concerned with the characterization of commercial thick-film conductors, i.e., gold, silver, copper, and gold-platinum (-palladium) systems. In addition, the preceding work explored vehicles, such as firing temperature and time, which influenced the basic processes of metal sintering and interactions with the adhesive agent. As a result of prior analyses, it became clear that factors which influence adhesion would differ with adhesive agent type, e.g., frit-bonded, mixed-bonded or reactively bonded. The present study addresses this distinction and explores the factors which primarily contribute to adhesion in each class. To simplify the discussion, the experiments in this year's study have been confined to gold films. GRA

N78-30212# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
ACCELERATED CORROSION OF ADHESIVELY BONDED

7075 ALUMINUM USING WEDGE CRACK SPECIMENS Final Report, Jan. 1976 - Jun. 1977
Neil T. McDevitt, William L. Baun, Gary Fugate, and James S. Solomon Oct. 1977 45 p refs
(AD-A054207; AFML-TR-77-184) Avail: NTIS HC A03/MF A01 CSCL 11/6

Accelerated corrosion of 7075 aluminum using the equal thickness adherend wedge test did not find flaws on the anodic oxide surface through the use of scotch tape contamination. It is apparent that the strength of the adhesive-oxide interface has to be much less than the center of the bond line in order for the wedge test to find the weakness. Author (GRA)

N78-30213# Battelle Columbus Labs., Ohio.
ENGINEERING DATA ON NEW AEROSPACE MATERIALS STRUCTURAL MATERIALS Final Summary Report, Feb. 1975 - Sep. 1977
Omar Deel Wright-Patterson AFB, Ohio AFML Dec. 1977 116 p
(Contract F33615-75-C-5065; AF Proj. 7381)
(AD-A054461; AFML-TR-77-198) Avail: NTIS HC A06/MF A01 CSCL 11/6

The major objectives of this program were to evaluate newly developed materials of interest to the Air Force for potential airframe structural usage, and to provide 'data sheet'-type presentations of engineering data for these materials. The materials effort on this program concentrated on MP 159 Multiphase Bar, Ti-6Al-2Sn-4Zr-2Mo castings, 7175-T73511 and -T76511 extrusions, 7050-T73 Extrusions, Ti-6Al-4V PM Product, Ti-6Al-4V superplastically formed product, Ti-10V-2Fe-3Al Alloy Bar, and 4330 M Steel Forgings. The properties investigated include tension, compression, shear, bearing, impact, tracture toughness, fatigue, creep and stress-rupture, and stress corrosion at selected temperatures. Author (GRA)

N78-30214# Giner, Inc., Waltham, Mass.
STUDY OF CORROSION AND ITS CONTROL IN ALUMINUM SOLAR COLLECTORS Annual Progress Report, 1 Jun. 1976 - 31 May 1977
J. Giner, F. H. Cocks, and D. Wong 1 Jun. 1977 89 p refs
(Contract EY-76-C-02-2934)
(COO/2934-4) Avail: NTIS HC A05/MF A01

The corrosion resistance of aluminum alloys in water/ethylene glycol mixtures was studied in detail under experimental conditions directly relevant to the operation of existing solar thermal energy collector systems. An aqueous ethylene glycol solution with 35% ethylene glycol by volume was chosen as the typical heat transfer medium throughout the entire program. The scope of this study covers the following range of conditions: (1) four different aluminum alloys (i.e., 99.9%, 1100, 3003 and 3004 series aluminum); (2) 70 to 210 F; (3) stagnant solution, laminar and turbulent flow; (4) under N2 and air; (5) in the presence of contaminants (e.g., Cl(-), Cu(+2) and Fe(+3) ions); and (6) effects of ethylene glycol decomposition products. The linear polarization resistance technique was used in determining the overall corrosion rate, along with accompanying quantitative metallographic analysis of pit formation and growth. ERA

N78-30215# General Atomic Co., San Diego, Calif.
ELECTRODE POLARIZATION STUDIES IN HOT CORROSION SYSTEMS Progress Report, 1 Jun. 1977 - 31 May 1978
O. F. Devereux Feb. 1978 34 p refs
(Contract EY-76-S-02-2960)
(COO-2960-2) Avail: NTIS HC A03/MF A01

Analysis of thermodynamic models pertaining to coal gasification is near completion. Model 1, comprising a gas phase and a molten salt phase, pertains to laboratory materials tested; model 2 incorporates as well a solid carbon phase and is intended to model typical gasifier environments. Anodic and cathodic polarization measurements on iron, 1018 steel, nickel, and 304 and 316 stainless steel were performed in molten sodium carbonate under air and oxygen. Preliminary metal/gas reactions tests involving iron, and hydrogen sulfide and nitrogen, were performed. Nitrogen reaction is minimal; hydrogen sulfide reaction is very nonuniform, rendering kinetic analysis difficult. ERA

N78-30216# Brown Univ., Providence, R. I. Div. of Engineering.
LIMITS TO DUCTILITY SET BY PLASTIC FLOW LOCALIZATION
A. Needleman and J. R. Rice Nov. 1977 56 p refs Presented at Symp. on Mechanics of Sheet Metal Forming, Warren, Mich., 17 Oct. 1977
(Contract EY-76-S-02-3084)
(COO-3084-57; Conf-7710125-1) Avail: NTIS HC A04/MF A01

The theory of strain localization was reviewed with reference both to local necking in sheet metal forming processes and to more general three dimensional shear band localizations that sometimes mark the onset of ductile rupture. Both bifurcation behavior and the growth of initial imperfections were considered. In addition to analyses based on classical Mises-like constitutive laws, approaches to localization based on constitutive models that may more accurately model processes of slip and progressive rupturing on the microscale in structural alloys are discussed. Among these nonclassical constitutive features are the destabilizing roles of yield surface vertices and of nonnormality effects, arising, for example, from slight pressure sensitivity of yield. Analyses based on a constitutive model of a progressively cavitating dilational plastic material which is intended to model the process of ductile void growth in metals are also discussed. A variety of numerical results are presented. ERA

N78-30217# California Univ., Berkeley. Lawrence Berkeley Lab.
POWDER METALLURGICAL PROCESSING OF MAGNETOSTRICTIVE MATERIALS BASED ON RARE EARTH-IRON INTERMETALLIC COMPOUNDS
M. Malekzadeh Jan. 1978 107 p refs
(Contract W-7405-eng-48)
(LBL-7347) Avail: NTIS HC A06/MF A01

Procedures are described for fabrication of high density rare earth-iron magnetostrictive compounds by powder metallurgical techniques. The fabrication involves a sequence of steps which includes preparing the pre-alloyed compounds, pulverizing them into a fine powder, compacting in suitable sizes and shapes, and sintering. Samples prepared by these procedures are characterized by scanning electron microscopy, X-ray diffraction, dilatometry, and magnetic measurements. Process steps are found to exert important influence upon densities, microstructure and magnetic properties attained after densification. Investigations on a number of these process steps, including milling time and medium, sintering, and magnetic powder alignment are described. ERA

N78-30218# California Univ., Berkeley. Lawrence Berkeley Lab.
LOW ALLOY STEELS FOR THICK WALL PRESSURE VESSELS Yearly Report, 1 Oct. 1976 - 30 Sep. 1977
R. M. Horn, E. R. Parker, and V. F. Zackay 1977 102 p refs
(Contract W-7405-eng-48)
(LBL-7357) Avail: NTIS HC A06/MF A01

A summary is presented of progress during the first year of a program to modify current ferrous alloys and develop low alloy steels that can be field fabricated into large diameter, thick walled pressure vessels for commercial coal gasifiers. Determination design criteria for the pressure vessel steels, incorporating information gained through review and gained through interaction with industry, national laboratory personnel, and research contractors is described. Work was performed to verify that simulation techniques lead to good reproducibility. Commercially produced material and small ingot material were evaluated. Primary effort was placed on carrying out studies in modified commercial alloy systems to direct scaled-up investigations. Transformation behavior, microstructural characterization and mechanical property assessment were placed on Mn-Mo-Ni steels, A533 types, and Cr-Mo steels. ERA

N78-30219# Oak Ridge Gaseous Diffusion Plant, Tenn.
POLARIZATION BEHAVIOR OF SELECTED CATHODIC REACTIONS USED IN CORROSION TESTING OF STAINLESS STEELS AND NICKEL BASE ALLOYS
V. C. Huffstetler Feb. 1978 119 p refs
(Contract W-7405-eng-26)

(K-2004) Avail: NTIS HC A06/MF A01

The electrochemical nature of three different acid solutions was examined and factors affecting the shape of the polarization curves were evaluated. Potentiodynamic polarization curves were obtained for 10% hydrochloric acid, 50% sulfuric acid-0.1 M ferric sulfate, and 10% chromic acid on a platinized platinum surface and on various nickel rich alloys. The polarization measurements were generally conducted at room temperature in hydrogen saturated solutions. However, several polarization curves were also measured in aerated solution in order to determine the influence of oxygen on the electrochemical characteristics of each acid. ERA

N78-30220# Knolls Atomic Power Lab., Schenectady, N. Y.
CORROSION FAILURE ANALYSIS AS RELATED TO PREVENTION OF CORROSION FAILURES
Henry Suss Oct. 1977 29 p Presented at ASM Meeting, Hartford, 8 Nov. 1977
(Contract EY-76-C-12-0012)
(KAPL-P-4057; Conf-771161-1) Avail: NTIS HC A03/MF A01

The factors and conditions which contributed to many of the corrosion related service failures are discussed based on a review of actual case histories. The anti-corrosion devices which were developed as a result of these failure analyses are reviewed, and the method which was used to take advantage of the available corrosion prevention techniques is discussed. ERA

N78-30221# Case Western Reserve Univ., Cleveland, Ohio.
ELASTIC AND PLASTIC STRAINS AND THE STRESS CORROSION CRACKING OF AUSTENITIC STAINLESS STEELS Progress Report, 30 Apr. - 30 Dec. 1977
A. R. Troiano Jan. 1978 43 p refs
(Contract EY-76-S-02-2576)
(COO-2576-6) Avail: NTIS HC A03/MF A01

A newly developed test environment based on NaCl, Na2SO4, and HCl has provided some insight to several aspects of SCC in a transformable austenitic stainless steel. Current vs. time curves indicated the presence of the formation of a protective film which drastically reduced the anodic current leading to failure. This film is subject to highly localized damage such as pitting. Corrosion or open circuit potential for both annealed and deformed material behaved in a similar manner, becoming more noble with time until it reached the critical cracking potential and SCC ensured. The failure time for the deformed specimens was substantially shorter than for the annealed ones, but the incubation time was essentially the same. It appears that the critical parameters leading to SCC in a chloride environment are primarily dependent on surface-environment interactions. ERA

N78-30222# California Univ., Berkeley.
DISCUSSION: TOUGHNESS VARIATIONS DURING THE TEMPERING OF A PLAIN CARBON MARTENSITIC STEEL, BY J. E. KING, R. F. SMITH AND J. F. KNOTT. RETAINED AUSTENITE AND TRANSGRANULAR TEMPERED MARTENSITE EMBRITTLEMENT
B. V. N. Rao and G. Thomas Jun 1977 12 p refs Presented at the 4th Intern. Conf. on Fracture, Waterloo, Canada, 19-24 Jun. 1977
(Contract W-7405-eng-48)
(LBL-6295; Conf-770601-5) Avail: NTIS HC A02/MF A01

Discussion is presented to substantiate, clarify, and reinterpret some of the results of studies on the existence and origin of tempered martensite embrittlement in relation to retained austenite, with reference to experimental steels. ERA

N78-30223# Department of Energy, Oak Ridge, Tenn.
FIRST FOUR YEARS OF OPERATION OF THE LNG PLANT AT SKIKDA (ALGERIA): CAUSES AND REMEDIES OF THE CORROSION OF CRYOGENIC EXCHANGES BY MERCURY
Bachir Khenat and Tewfik Hasni [1978] 16 p Transl. into ENGLISH from unidentified Algerian report
(DOE-TR-16) Avail: NTIS HC A03/MF A01

A report of Skikda LNG plant startup is presented. Discussions are included on the different major technical accidents which occurred in the plant, and the training and installation of operating personnel of the customer. A view is also presented of performances obtained by the plant in general and by certain large equipments in particular including the large axial compressors of the refrigeration cycle, the cryogenic exchangers, and the LNG storage tanks. The first four years of plant operation is summarized emphasizing equipment operation and personnel management. An account of experience with mercury caused corrosion of cryogenic exchangers is included. Author (ERA)

N78-30224# Sandia Labs., Albuquerque, N. Mex.
EFFECT OF SHOCK WAVE RISETIME ON MATERIAL EJECTION FROM ALUMINUM SURFACES
J. R. Asay 15 Sep. 1977 37 p refs
(Contract EY-76-C-04-0789)
(SAND-77-0731) Avail: NTIS HC A03/MF A01

Loading stresses of 21 GPa were accomplished with plate impact techniques by mounting specimens on a ramp wave generator. Projectile impact on one side of the wave generator produced a wave which dispersed with propagation distance. This wave was then made incident to an aluminum specimen, so that the specimen experienced non-shock loading. It was found that mass ejection from aluminum surfaces can be reduced by over two orders of magnitude relative to shock loading conditions by accelerating the surface with a wave risetime greater than about 35 ns. ERA

N78-30225# California Univ., Livermore. Lawrence Livermore Lab.
PRELIMINARY MICROSTRUCTURAL CHARACTERIZATION BY TRANSMISSION ELECTRON MICROSCOPY OF 14 MeV NEUTRON IRRADIATED TYPE 316 STAINLESS STEEL
C. J. Echer 23 Sep. 1977 12 p refs
(Contract W-7405-eng-48)
(UCID-17609) Avail: NTIS HC A02/MF A01

Substantial changes in the mechanical properties of 316 stainless steel were observed after neutron irradiation (phi/sub t/ = 2.3 x 10 to the 21st power n/sqm and E = 14 MeV) at 25 C. Comparison of microstructures of the unirradiated and neutron irradiated materials were evaluated using transmission electron microscopy. Evidence of small defect clusters in the irradiated materials was found. ERA

N78-30226# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
PRODUCT FORM CHARACTERIZATION OF REFERENCE HEAT OF TYPE 316 STAINLESS STEELS
V. K. Sikka Mar. 1978 111 p refs
(Contract W-7405-eng-26)
(ORNL-5384) Avail: NTIS HC A06/MF A01

Tensile properties and microstructure of specimens cold-worked from 0 to 30 percent and annealed for 0.5 hr at 1065 or 1150 C were studied to explain differences observed in tensile properties of various product forms of type 316 stainless steel. ERA

N78-30227# Sandia Labs., Livermore, Calif. Materials Dept.
FORMATION OF PROTECTIVE LAYERS ON ALLOYS USED IN COAL GASIFICATION ENVIRONMENTS Quarterly Progress Report, 1 Apr. - 30 Jun. 1977
R. W. Bradshaw, R. E. Stoltz, and D. R. Adolphson Nov. 1977 36 p
(Contract EY-76-C-04-0789)
(SAND-77-8277) Avail: NTIS HC A03/MF A01

Alloys which resist corrosive coal gasification atmospheres better than existing high temperature alloys such as 310 stainless steel and Ni-Cr binary alloys were investigated. Minor alloying elements were added to existing high temperature alloys which form protective sulfide layers or improved oxide layers in addition to or in place of the usual oxide layer. The protective layers should be spall resistant under the thermal and mechanical cycling conditions encountered in coal gasifiers and be self-healing, in case of failure by cracking or erosion. The level of alloying additions was adjusted to maximize corrosion resistance while at the same time minimize deleterious effects on mechanical properties and fabricability. ERA

N78-30228# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Reactors Div.
CORROSION BEHAVIOR OF SODIUM-EXPOSED STAINLESS STEELS IN CHLORIDE-CONTAINING AQUEOUS SOLUTIONS

P. C. S. Wu Dec. 1977 87 p refs Prepared for ORNL
(Contract W-7405-eng-26)
(ORNL/TM-6068) Avail: NTIS HC A05/MF A01

Corrosion behavior of sodium exposed stainless steels in typical water pool conditions was investigated to assess the feasibility of water storage concepts for the LMFBR spent fuels. A screening study of sodium-corroded, 20% cold worked Type 316 stainless steel (prototypic LMFBR cladding alloy) with the sodium removed by alcohol or water vapor/argon and/or steam/argon process is presented. The results show that no observable material deterioration or failure occurred among specimens manufactured from this material and tested under pressurized condition (35) psi) at 82 C for periods up to five months in various water baths with chloride content above 500 ppM. ERA

N78-30229# Hanford Engineering Development Lab., Richland, Wash.
MICROSTRUCTURAL CHARACTERIZATION OF ADVANCED FERROUS ALLOYS EXPOSED TO LIQUID SODIUM
R. P. Anantatmula, S. J. Mayhan, and P. A. White Jul. 1977 10 p refs Presented at 10th Ann. Technical Meeting of the Intern. Metallographic Soc., Houston, Tex., 19 Jul. 1977 Revised
(Contract EY-76-C-14-2170)
(HEDL-SA-1225FP-Rev; Conf-770739-1) Avail: NTIS HC A02/MF A01

The property requirements for breeder reactor fuel cladding materials are extremely stringent. Alloys with low sodium corrosion rates are required to avoid loss of strength from wall thinning at reactor operating temperatures. Data obtained on the following alloys are described: A-286, Inconel 706, Nimonic PE16, AISI 316, M-813 (sintered), Inconcel 718, AISI 310, and Alloy 330. Tests were carried out at 700 C for 2000 hours at a sodium velocity of 6 m/s and an oxygen content in sodium of 1 ppM. Corrosion rates and major elements depleted are tabulated. Both A-286, Inconel 706, and Nimonic PE16 are highly promising commercial alloys for cladding purposes on the basis of corrosion resistance. ERA

N78-30230# National Engineering Lab., East Kilbride (Scotland). Formation and Fabrication Div.
COLD EXTRUSION OF SIX LOW-ALLOY CASE-HARDENING STEELS
J. C. Hendry Aug. 1977 21 p refs
(NEL-642) Avail: NTIS HC A02/MF A01

Extrusion pressure data are presented for both the forward extrusion of rod and the backward extrusion of can in six low-alloy, case-hardening steels, En 351, En 352, En 353, En 354, En 355, and En 361 to examine their extrudability and to determine the maximum pressures necessary to extrude rods and cans at selected extrusion ratios. The extrusion of these steels requires pressures 20 to 60% higher than those required for similar operations when a cold-forming steel (En 2E) is used. Author (ESA)

N78-30281 Aeronautical Research Labs., Melbourne (Australia).
AIRCRAFT STRUCTURAL LIFE MONITORING AND THE PROBLEM OF CORROSION
L. M. Bland *In its* Aircraft Structural Fatigue Apr. 1977 p 227-253 refs (For primary document see N78-30271 21-31)
Copyright. Avail: Issuing Activity

N78-30289 Aeronautical Research Labs., Melbourne (Australia).
THE INFLUENCE OF THE WATER VAPOUR CONTENT AND THE TEMPERATURE OF AN AIR ENVIRONMENT ON THE FATIGUE BEHAVIOR OF SAE 4340 STEEL
D. S. Kemsley *In its* Aircraft Structural Fatigue Apr. 1977 p 459-477 refs (For primary document see N78-30271 21-31)
Copyright. Avail: Issuing Activity

N78-30290 Aeronautical Research Labs., Melbourne (Australia).
THE USE OF ADHERENT ALUMINUM FOILS FOR FATIGUE METERING
R. A. Coyle and M. E. Packer *In its* Aircraft Structural Fatigue Apr. 1977 p 479-497 refs (For primary document see N78-30271 21-31)
Copyright. Avail: Issuing Activity

N78-30390# Miami Univ., Fla.
AUTOMOTIVE MATERIALS COMPATIBILITY WITH METHANOL FUEL BLENDS
L. E. Poteat *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 707-711
(For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N78-30231 Massachusetts Univ., Amherst.
BOUNDED COATING FLOWS OF VISCOUS AND VISCOELASTIC FLUIDS Ph.D. Thesis
Jehuda Greener 1978 390 p
Avail: Univ. Microfilms Order No. 7810722

The effect of fluid rheology in a rigid planar blade coater, a sheet-and-roll system, and a system using half-immersed counter rotating rollers was investigated. Hydrodynamic models were developed for each system using lubrication approximation. The thickness of several Newtonian and several viscoelastic coatings was measured. The question of stability in coating flows was considered through a study of the ribbing phenomenon. A physical stability theory that is capable of explaining some of the observed differences for Newtonian and viscoelastic fluids is presented. Dissert. Abstr.

N78-30232 Marquette Univ., Milwaukee, Wis.
ELECTRICAL CONDUCTIVITY AND THERMODYNAMIC STUDY OF TANTALUM PENTOXIDE DOPED NONSTOICHIOMETRIC CERIUM DIOXIDE Ph.D. Thesis
Ravinder Kumar Sharma 1977 155 p
Avail: Univ. Microfilms Order No. 78-10295

Thermogravimetric and electrical conductivity measurements were made on Ta2O5 -doped nonstoichiometric cerium dioxide as a function of temperature and oxygen partial pressure. An expression for representing the compositional and temperature dependence of the electrical conductivity is given for the temperature range 800 C to 1300 C., where the activation energy of electron motion is a function of both dopant and nonstoichiometry. Dissert. Abstr.

N78-30233 Marquette Univ., Milwaukee, Wis.
HIGH PRESSURE NEUTRON DIFFRACTION STUDY OF CERAMIC NITRIDES Ph.D. Thesis
Saroja Rangegowda Srinivasa 1977 201 p
Avail: Univ. Microfilms Order No. 78-10297

The effect of pressure on the crystal structures of silicon oxynitride, germanium oxynitride, alpha and beta polymorphs of silicon nitride was measured at pressures up to 35 kbars at room temperature using neutron time of flight diffraction techniques. The data were analyzed employing multicomponent profile refinement to obtain lattice parameters, atomic position parameters and isotropic temperature factors at each pressure. For the framework structures, such as silicates, oxynitrides, and nitrides, the compressibility behavior depends on whether the bond angles between the polyhedra are rigid or flexible, corresponding to fully expanded or collapsed structures. A similar relationship for thermal expansion is known for framework structure such as silicates and niobates. Dissert. Abstr.

N78-30234*# Technochemie G.m.b.H., Heidelberg (West Germany).
BISMALEIMIDE RESINS FOR FLAME RESISTANT HONEYCOMB SANDWICH PANELS
H. D. Stenzenberger Jul. 1978 51 p refs
(Contract NASw-3081)
(NASA-CR-157401; Rept-7807) Avail: NTIS HC A04/MF A01 CSCL 11G

Bismaleimide resins are prime candidates for nonflammable aircraft interior panels. Three resin types with different structures and processing characteristics were formulated. Resin M 751 was used to fabricate 100 kg of glass fabric prepregs which

were used for the preparation of face sheets for honeycomb sandwich panels. Prepreg characteristics and curing cycles for laminate fabrication are provided. In order to advance beyond the current solvent resin technology for fibre and fabric impregnation, a hot melt solvent-less resin system was prepared and characterized. Preliminary tests were performed to develop a wet bonding process for the fabrication of advanced sandwich honeycomb panels by use of polybismaleimide glass fabric face sheets and polybismaleimide Nomex honeycomb core. B-stage material was used for both the core and the face sheet, providing flatwise tensile properties equivalent to those obtained by the state-of-the-art 3-step process which includes an epoxy adhesive resin. B.B.

N78-30235*# Washington Univ., Seattle. Coll. of Engineering.
INTERDISCIPLINARY RESEARCH AND DEVELOPMENT ON THE EFFECTS OF THE NATURE AND PROPERTIES OF CERAMIC MATERIALS IN THE DESIGN OF ADVANCED STRUCTURAL COMPONENTS Semiannual Status Report
1 Jul. 1978 42 p
(Grant NGR-48-002-004)
(NASA-CR-156949; CMR-SASR-30) Avail: NTIS HC A03/MF A01 CSCL 11B

Proposals are presented in supportive and interdisciplinary research from the University of Washington. G.Y.

N78-30236# Chemical Engineering Research Group, Pretoria (South Africa).
EFFECT OF HEAT ON FLEXING FATIGUE IN A GLASS FIBRE FILTER CLOTH
S. T. R. Wilkins Aug. 1977 23 p refs
(CSIR-CENG-204; ISBN-0-7988-1188-9) Avail: NTIS HC A02/MF A01

Bag filtration was examined as an effective means of fine dust collection. Problems that occur when applied to the high-temperature (greater than 150 C) filtration which is desirable in order to minimize expense and corrosion dangers resulting from the cooling of hot gases were also studied. The material used must be temperature-resistant and capable of withstanding the mechanical wear experienced during the removal of the filter cake (at high temperatures). The latter is effected by reversing the gas flow which casuses partial collapse of the filter bag tubes with simultaneous mechanical or sonic vibration of either the bag or the gas. In some cases the frequency of this cleaning cycle is high due to the high dust load and the high resistance to gas flow in the filter cake. The repeated filtration and cleaning cycle requires good flexing endurance. B.B.

N78-30237# National Physical Research Lab., Pretoria (South Africa). Physics of Materials Div.
THE DEVELOPMENT OF INFRARED TRANSMITTING DOMES
J. Bednarik May 1977 69 p refs
(CSIR-FIZ-140; ISBN-0-7988-1181-1) Avail: NTIS HC A04/MF A01

A study of infrared transmitting glasses was initiated because of interest in glass filters that will transmit radiation between 3,6-4,8 microns with maximum transmittance at 4,2 microns. These glasses must preferably be transparent to at least part of the visible spectrum, have sufficient strength as well as thermal-shock properties comparable to conventional silicate glasses and, in the final stage, be capable of being manufactured in relatively large sizes. Additionally, the glass must be resistant to moisture attack and have a low index of refraction comparable to commercial glasses. The final requirement is to produce hemispherical blank domes with internal radius 58 mm and outer radius 66 mm of reasonable and reproducible quality. G.Y.

N78-30238*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FRICTION AND WEAR OF METALS WITH A SINGLE-CRYSTAL ABRASIVE GRIT OF SILICON CARBIDE: EFFECT OF SHEAR STRENGTH OF METAL
Kazuhisa Miyoshi (Kanazawa Univ., Japan) and Donald H. Buckley Aug. 1978 27 p refs
(NASA-TP-1293; E-9499) Avail: NTIS HC A03/MF A01 CSCL 11G

Sliding friction experiments were conducted with spherical, single-crystal silicon carbide riders in contact with various metals and with metal riders in contact with silicon carbide flats. Results indicate that: (1) the friction force in the plowing of metal and (2) the groove height (corresponding to the volume of the groove) are related to the shear strength of the metal. That is, they decrease linearly as the shear strength of the bulk metal increases. Grooves are formed in metals primarily from plastic deformation, with occasional metal removal. The relation between the groove width D and the load W can be expressed by $W = kD^n$, superscript n which satisfies Meyer's law. Author

N78-30239# McDonnell Aircraft Co., St. Louis, Mo.
TEST PROGRAM EVALUATION OF HERCULES 3501-6 RESIN Final Report, 28 Feb. 1977 - 28 Feb. 1978
J. F. Carpenter May 1978 85 p refs
(Contract N00019-77-C-0155)
(AD-A054283) Avail: NTIS HC A05/MF A01 CSCL 11/9

Sixteen chemically altered batches of 3501-6 resin were analyzed by physiochemical techniques and by dynamic mechanical analysis to determine the effects of known variations in chemical composition on dynamic mechanical properties, processability and moisture sensitivity of this system. An advanced analytical technique, reverse phase liquid-liquid chromatography was also developed. Author (GRA)

N78-30240# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ENHANCED HETEROEPITAXY Semiannual Technical Summary Report, 1 Jan. - 30 Jun. 1977
Alan L. McWhorter 30 Jun. 1977 19 p refs
(Contract F19628-76-C-0002; ARPA Order 3336)
(AD-A054159; ESD-TR-77-359) Avail: NTIS HC A02/MF A01 CSCL 11/2

In order to determine the feasibility of using submicrometer-dimension surface-relief structures to control the orientation of deposited thin films, a technology for fabricating the required structures is being developed. The technology involves holographic lithography, X-ray lithography, and reactive ion etching. A recently developed process for fabricating polyimide-membrane X-ray-lithography masks with thicknesses ranging from 0.5 to several micrometers, and measurements of distortion in such masks are reported. GRA

N78-30241# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
ASSESSMENT OF CERAMIC-MATRIX COMPOSITE TECHNOLOGY AND POTENTIAL DOD APPLICATION Final Report, Jan. - Dec. 1977
John E. Hove and H. Mauzee Davis Dec. 1977 182 p refs
(Contract DAHC15-73-C-0200)
(AD-A054017; AD-E500028; P-1307) Avail: NTIS HC A09/MF A01 CSCL 11/4

A study was made of ceramic-matrix composite (CMC) technology for the purpose of assessing: (1) the potential usefulness of such materials to DoD systems, (2) the present scientific and engineering state of affairs for such materials, (3) whether the DoD should contemplate new projects for such materials, and, if so, (4) what should be the technical nature and direction of such projects. Areas of beneficial applications are outlined, and it appears clear that the potential usefulness of CMCs to DoD systems is high and very broad in scope. Although there are a few exceptions, it does not seem to be quite so clear which areas of the technology are likely to prove the most promising for instigating future programs. GRA

N78-30242# Celanese Research Co., Summit, N.J.
EFFECTS OF MOISTURE ON CHEMICAL INTERACTIONS AT A POLYMER-FIBER INTERFACE Technical Report, May 1976 - Aug. 1977
D. E. Stuetz, R. E. Sullivan, A. DiEdwardo, G. Hardy, O. D. Recca, and P. McMahon Dec. 1977 112 p refs
(Contract F33615-76-C-5223; AF Proj. 7340)
(AD-A054460; AFML-TR-77-214) Avail: NTIS HC A06/MF A01 CSCL 11/2

The objective of this investigation was to determine the effects of moisture and temperature on chemical interactions at the interface of a specific graphite fiber/epoxy resin composite. Studies to evaluate these effects comprised the determination

of the number and type of surface sites on a Celion R GY-70 graphite fiber, that react with epoxy groups; the measurement of the rate of degradation of these sites under dry and humid conditions at elevated temperatures; and a comparison of these rates with rates of the irreversible loss of interface properties of graphite fiber/epoxy resin composites. From these results it was concluded that cleavage of fiber/resin interface bonds may be discounted as the source for the irreversible strength losses experienced in graphite fiber/epoxy resin composites. GRA

N78-30243# Army Construction Engineering Research Lab., Champaign, Ill.

CONSTRUCTION WITH FIELD MOLDABLE POLYURETHANE FOAM BLOCKS Final Report

Alvin Smith Apr. 1978 50 p refs
(DA Proj. 4A7-62619-AT-41)
(AD-A054440; CERL-TR-M-233) Avail: NTIS HC A03/MF A01 CSCL 11/9

This report presents the results of an investigation of the use of polyurethane foam for expedient shelters in the theater of operations (TO). The evaluation showed that polyurethane foam can bring about significant savings in material shipping weight and volume, construction time, and required personnel skill levels, compared to present base development materials. A model structure was erected in which the wall components were building blocks molded from a low density foam. The building blocks can be fabricated in the field by low-skill personnel using simple molds and mixing equipment. The blocks are equal in size to two regular 8 by 8 by 16 in. (203 by 203 x 406 mm) concrete blocks and weigh about 4 lb (1.8 kg) each. They can be rapidly assembled into a wall using an adhesive applied by caulking gun. Conventional foundation, floor, and roofing systems can be used with this wall system. Author (GRA)

N78-30244# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.

DISCUSSION OF HYDRAULIC FLUID FLAMMABILITY HAZARDS Interim Report, 1 Oct. 1976 - 1 Oct. 1977

Bernard R. Wright Dec. 1977 25 p refs
(Contracts DAAG53-76-C-0003; DAAK70-78-C-0001)
(AD-A054560; AFLRL-95) Avail: NTIS HC A02/MF A01 CSCL 11/8

Hydraulic fluid flammability has been evaluated for fire-resistant fluid candidates and approved fluids. Hazards directly related to the M60A1 tank have been discussed. A systematic assessment of flammability modes and ignition sources is presented. Experimental results indicate that mist flammability is more related to exposure conditions than to hydraulic fluid classes. Pool burning has been shown to be a major hazard, and the higher flash point fluids have been shown to provide a substantial margin of safety relative to conventional petroleum-base fluids. Results of ballistic tests using 20 mm HEIT projectiles demonstrated residual burning on the backstop (analogous to pool burning) only when conventional petroleum-base fluids were evaluated, otherwise, only a transient mist fireball was observed. Author (GRA)

N78-30245# Lehigh Univ., Bethlehem, Pa. Materials Research Center.

INFLUENCE OF CROSSLINKING ON THE MECHANICAL PROPERTIES OF HIGH T SUB G POLYMERS Final Report, May 1975 - Apr. 1977

John A. Manson, Leslie H. Sperling, and Soojaa L. Kim Jul. 1977 146 p refs
(Contract F33615-75-C-5167)
(AD-A054431; AFML-TR-77-109) Avail: NTIS HC A07/MF A01 CSCL 11/9

A study was conducted on the effects of crosslinking on the mechanical properties of high-T(g) polymers, with emphasis on the role of average crosslink density and on variations in the distribution of chain lengths between crosslinks. Two model systems were used: one based on the use of polystyrene/polystyrene interpenetrating polymer networks (Millar networks), and the other based on the use of bisphenol-A-type epoxy/methylene dianiline resins synthesized to provide controlled variations in network properties. With the Millar networks, which were prepared by polymerizing a crosslinking polystyrene network within a precrosslinked polystyrene matrix, measurements of creep, swelling, and rubbery modulus showed that the properties at equal average crosslink density were dominated by the crosslink density of the first-formed network. Thus, when networks formed at different times can interpenetrate, the continuity or coherence of each plays a major role in determining behavior. With the epoxy networks, viscoelastic and elastic response, stress-strain and impact behavior, fatigue crack propagation, and fracture toughness were determined primarily by the average crosslink density. A model was proposed to account for the morphologies and mechanical properties observed. GRA

N78-30246# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.

ELECTRIC FIELD-INDUCED STRUCTURE IN POLY (ACRYLONITRILE)

S. I. Stupp and S. H. Carr 15 May 1978 23 p refs Submitted for publication
(Contract N00014-75-C-0963; NR Proj. 051-590)
(AD-A054615; TR-5) Avail: NTIS HC A02/MF A01 CSCL 11/9

Experimental evidence has been obtained for alteration of the molecular organization in polyacrylonitrile which has been given a thermoelectric treatment that creates a persistent electrical polarization. These studies have involved infrared spectroscopy and X-ray diffractometry, and their results have been interpreted as suggesting the existence of dipolar clusters in polarized material. These clusters cause polyacrylonitrile chains to adopt a structure which is different from any previously reported for this material. It is suggested that stability of the polarized state of polyacrylonitrile results, in part, from this new molecular organization. Author (GRA)

N78-30247# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Elastomers and Coatings Branch.

FUNDAMENTALS OF NONCURING SEALANTS FOR AIRCRAFT FUEL TANKS Final Report, Jan. 1975 - Jan. 1977

Warren R. Griffin Dec. 1977 95 p refs
(AD-A054627; AFML-TR-77-195) Avail: NTIS HC A05/MF A01 CSCL 11/1

The need for efficient space utilization in military aircraft has led to the use of wing and fuselage cavities as fuel tanks. Of the three methods of sealing these cavities (filleting, faying, and channel), channel sealants are the least understood and have the most contrast between behavior and requirements. Potential failure mechanisms were identified against the thermal, chemical, and physical aspects of the fuel tank environment. Thermal degradation, low temperature embrittlement, thermal expansion, and viscosity reduction were mechanisms associated with the -54 C to +177 C temperature range. Hydrolysis, oxidation, closed system reversion, and crosslinking were associated with the chemical aspect. Fuel swelling of the sealant, extraction by fuel, system pressure, vibration, shear, and adhesion/cohesion were associated with the physical aspect. Selected polymers with a wide variety of formulating ingredients were evaluated as channel sealants in laboratory-sized test apparatus to confirm the suspected failure mechanisms. The results have been digested as engineering principles that govern the behavior of channel sealants. Application of these principles resulted in some immediate benefits and a basis for long range sealant development. GRA

N78-30248# Army Materials and Mechanics Research Center, Watertown, Mass. Polymer and Chemistry Div.

EVALUATION OF NEW TECHNIQUES FOR THE QUALITY CONTROL OF EPOXY RESIN FORMULATIONS Final Report

Gary L. Hagnauer, James F. Sprouse, Robert E. Sacher, Isaac Setton, and Michael Wood Jan. 1978 29 p
(DA Proj. 1L1-62105-AH-84)
(AD-A054625; AMMRC-TR-78-8) Avail: NTIS HC A03/MF A01 CSCL 11/9

Three different techniques are utilized to assess chemical composition and/or degree of B-staging for four resin samples containing an MY720 resin, a diaminodiphenylsulfone (DDS) hardener and a BF3 complex catalyst. These techniques are liquid chromatography, Fourier transform infrared spectroscopy, and differential scanning calorimetry analysis. These techniques and

their applicability are discussed in separate sections.
Author (GRA)

N78-30249# Naval Weapons Center, China Lake, Calif. Research Dept.
POLYMERIC BINDERS WHICH REVERSIBLY DISSOCIATE AT ELEVATED TEMPERATURES Research Report, Jul. 1975 - Sep. 1977
Ronald A. Henry, Eugene C. Martin, and Warren J. Murbach May 1978 64 p refs
(SF53354316)
(AD-A054930; NWC-TP-5995) Avail: NTIS HC A04/MF A01 CSCL 19/1

The synthesis of polyurethane binders, which reversibly dissociate into liquid prepolymers and/or comonomers when heated to 140-150 C and which re-cure to polymer after several days at 25 C, is described. GRA

N78-30250# Baylor Univ., Waco, Tex.
RADIATION CHEMISTRY OF HIGH POLYMERS Final Report
M. Dole and R. A. Welch 1977 28 p refs
(Contract EY-76-S-05-4059)
(ORO-4059-7) Avail: NTIS HC A03/MF A01

Radiation intensity calibration for a gamma ray source as a function of height and horizontal displacement was completed. For extended chain (high crystallinity) polyethylene (PE) before and after quenching from the melt irradiated at room temperature, the crosslinking yield increased twofold on lowering the crystallinity from 96 to 70%. The G-value for alkyl radical production was about 75% higher in the quenched extended chain sample as compared to the value before quenching. The G (alkyl) values were determined for irradiations at 77K. The rate of decay of the alkyl radicals in PE samples of single crystals having different stem lengths was studied at 80 and 85 deg. It was found that the mole fraction of the slowly decaying free radicals increased with the stem length. Hydrogen gas was found to catalyze both the slow and fast decays. ERA

N78-30251# Oak Ridge National Lab., Tenn.
CERAMIC PROCESSING OF BORON NITRIDE INSULATORS
C. S. Morgan and R. W. McCulloch 1977 8 p ref Presented at 14th Conf. on Ceram. Sci. Process. of Crystalline Ceram., Raleigh, N. C., 7 Nov. 1977
(Contract W-7405-eng-26)
(CONF-771137-2) Avail: NTIS HC A02/MF A01

Fuel pin simulators (FPS) are the prime elements of several test facilities used to conduct out-of-reactor thermal-hydraulic and mechanical interaction safety tests for both light-water and breeder reactor programs. The FPS units simulate the geometry, heat flux profiles, and operational capabilities of a reactor core element under steady-state and transient conditions. They are subjected to temperatures as high as 1600 C and power levels as high as 57.7 kW/m as well as severe thermal stresses during transient tests. Boron nitride (BN),because of its high degree of chemical inertness combined with its relatively unique properties of high thermal conductivity and low electrical conductivity, is the most suitable insulating material for FPS. The important BN properties, thermal conductivity and electrical resistance, are strongly influenced by crystallite orientation and by impurities. New BN powder processing techniques are described which optimize these properties. ERA

N78-30252# California Univ., Livermore. Lawrence Livermore Lab.
EPOXY MATRICES FOR FILAMENT-WOUND FLYWHEELS
J. A. Rinde, E. T. Mones, and T. T. Chiao 20 Oct. 1977 5 p refs Presented at Flywheel Technol. Symp., San Francisco, 5-7 Oct. 1977
(Contract W-7405-eng-48)
(UCRL-79573; Conf-771053-9) Avail: NTIS HC A02/MF A01

Epoxies are popular as matrix materials for composite flywheels. Depending on the design, the required matrix properites may differ greatly. Results of the study that a moderate-temperature-curable epoxy as well as a rubberized, high-temperature-resistant epoxy will meet the specific requirements for composite flywheels are presented. In addition, preliminary data on flexible long elongation epoxies for flywheel applications are not encouraging. ERA

N78-30253# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Nuclear Research Div.
REACTIONS AND DIFFUSION IN THE SILVER-ARSENIC CHALCOGENIDE GLASS SYSTEM Ph.D. Thesis
G. A. Holmquist Sep. 1977 49 p refs
(LBL-6922) Avail: NTIS HC A03/MF A01

The diffusion of Ag in amorphous As2S3 and As3Se3 at 175 C is accompanied with the reduction of As from a valence of +3 to +2 and +2 to +1 to maintain charge neutrality in the glass. The reactions for the sulfide and selenide glasses are identical. The AG(+) alone diffuses at this temperature, all other ions are essentially immobile. An amorphous reaction product phase is formed in thediffusion zone with a composition range of 28.6 to 44.4 atomic percent Ag. The lower limit corresponds to all As cations of +2 valence (amorphous Ag2As2S3). The upper limit, the maximum solubility of Ag in these glasses, corresponds to all As cations of +1 valence (amorphous Ag4As2S3). The diffusivity of Ag in these glasses at 175 C in the concentration range of 10 to 35 atomic percent Ag is: Sulfide--4 x 10 to the -14th power exp(+0.23 +0.23 +- .01)(atomic % Ag), Selenide--2 x 10 to the -12th power exp (+0.14 +- .01)(atomic % Ag). ERA

N78-30254# Oak Ridge National Lab., Tenn.
MECHANICAL CHARACTERIZATION OF SELECTED ADHESIVES AND BULK MATERIALS AT LIQUID NITROGEN AND ROOM TEMPERATURES
C. M. Fitzpatrick and W. C. T. Stoddart 1977 7 p refs Presented at 7th Symp. on Fusion Res. Project, Knoxville, Tenn., 25 Oct. 1977
(Contract W-7405-eng-26)
(CONF-771029-65) Avail: NTIS HC A02/MF A01

Selected adhesives and bulk materials of general interest to designers of magnets for cryogenic service were tested. Several epoxies, a varnish, a B-stage glass cloth, insulation papers, and commercially available fiber-reinforced composites were studied at room temperature (293 K) and at liquid nitrogen temperature (77). The tests include both simple tension tests and lap shear tests with various adherends. The parameters critical to tensile or bond strength were varied as part of the test program. The procedures used to manufacture and test these specimens and the results of the tests are reported. ERA

N78-30255# Addis Translations International, Portola Valley, Calif.
USE OF NEW SYNTHETIC POLYCRYSTALLINE MATERIALS: CARBONADO-TYPE DIAMOND AND CUBIC BORON NITRIDE
Yu. S. Konyaev Sep. 1977 11 p Transl. into ENGLISH of "Primeneniye Novykh Sinteticheskikh Polikristallicheskikh Materialov: Almaza Tipa Karbonado i Kubicheskogo Nitritsa Bora", Rept. Inst. of High Pressure Phys., USSR Acad. of Sci., 1977 10 p Sponsored by DOE Prepared for Calif. Univ., Livermore. Lawrence Livermore Lab.
(UCRL-Trans-11274) Avail: NTIS HC A02/MF A01

Problems of the practical use of new synthetic polycrystalline materials, carbonado-type diamond and cubic boron nitride are considered. Specific types of cutting, drilling, and stoneworking tools are listed and some recommendations are made for their practical use. ERA

N78-30256# Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
PHYSICAL PROPERTIES OF THE CHALCOGENIDES OF RARE EARTH ELEMENTS
A. V. Golubkov, E. U. Goncharova, V. P. Zhuze, ed., G. M. Loginov, V. M. Sergeeva, and I. A. Smirnova Dec. 1977 538 p refs Transl. into ENGLISH of the book "Fizicheskie Svoistva Khal'kogenidov Redkoz emel'nykh Elementov' Leningrad, Nauka Press, 1973 538 p Sponsored by DoE and NSF
(DOE-TR-6; TT-74-52056) Avail: NTIS HC A23/MF A01

Results of experimental and theoretical investigation of the physical and physico-chemical properties of chalcogenides of rare-earth elements are presented. The phase diagrams and crystal-chemical characteristics are given and the nature of the

chemical bonds is discussed. The methods of synthesis, crystal growth, and identification of compounds are briefly described. The phenomena of electron transfer (electrical conductivity, thermomagnetic, and galvanomagnetic effects) in a wide temperature range and also the effect of pressure on the electrical properties of chalcogenides of bivalent rare-earth elements are examined. The thermal properties of different groups of chalcogenides (heat capacity, thermal expansion, thermal conductivity) and their magnetic properties in the paramagnetic range and in the range of magnetic ordering are described; the mechanisms of exchange interactions in compounds of rare-earth elements are analyzed. The effect of temperature and magnetic field on the optical and magnetooptical properties of different groups of chalcogenides is studied. Some information on band structure is given. The industrial use of chalcogenides of rare-earth elements is briefly examined. ERDA

N78-30257# National Engineering Lab., East Kilbride (Scotland). Creep and Tribology Div.
EFFECT OF RESIN FLEXIBILITY ON THE STRENGTH OF GLASS FILAMENT-WOUND TUBES. PART 1: BIAXIAL LOADING
W. S. Carswell and R. Gemmell Aug. 1977 22 p refs
(NEL-643) Avail: NTIS . HC A02/MF A01

Glass filament-wound plastic pipes were tested biaxially under internal pressure to determine weeping and burst characteristics. The pipes had been manufactured with one angle of winding with three resin matrices of varying strains to failure. The resin has little influence on the burst pressure, but the pressure at weeping increases with resin flexibility. Author (ESA)

N78-30258# National Bureau of Standards, Washington, D. C.
PERFORMANCE OF PLASTIC PACKAGING FOR HAZARDOUS MATERIALS TRANSPORTATION. PART 3: STRESS CRACKING Final Report, Jun. 1976 - Jun. 1977
John M. Crissman and Louis J. Zapas Dec. 1977 58 p refs
(Contract DOT-AS-50074)
(PB-280215/5; NBSIR-77-1410-Pt-3; DOT-MTB-OHMO-77-4)
Avail: NTIS HC A04/MF A01 CSCL 11I

The emphasis is directed toward providing background information and laboratory studies on the subject of stress cracking, the results of which are pertinent to the establishment of performance criteria. The stress-cracking tests currently in common use are reviewed and background material taken from the technical literature and germane to the subject of stress cracking in polyethylene is presented. Recommendations for strengthening current DOT regulations in the areas of mechanical properties and stress crack resistance are given. GRA

N78-30310# Army Materials and Mechanics Research Center, Watertown, Mass. Ceramics Research Div.
REVIEW OF DURABILITY TESTING OF STRUCTURAL CERAMICS
R. Nathan Katz *In* DOE Highway Vehicle Systems Mar. 1978 p 208-224 refs (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

N78-30341# Army Materials and Mechanics Research Center, Watertown, Mass.
REVIEW OF PROOF TESTING ACTIVITIES IN STRUCTURAL CERAMICS
E. M. Lenoe *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 164-179 refs (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

N78-30345# Corning Glass Works, N.Y.
ALUMINOUS KEATITE: A NEW CERAMIC REGENERATOR CORE MATERIAL
D. G. Grossman *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 235-247 refs (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N78-30259# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.
EFFECTS OF HIGH AVAILABILITY FUELS ON COMBUSTOR PROPERTIES Interim Report
C. A. Moses and D. W. Naegeli Jan. 1978 100 p refs
(Contracts DAAG53-76-C-0003; DAAK70-78-C-0001)
(AD-A054229; AFLRL-101) Avail: NTIS HC A05/MF A01 CSCL 21/5

Engines now in production or under development were designed for satisfactory performance and life on current specification fuels; many of these engines may not be able to handle the stress implied by a broadened fuel specification. Among the fuel properties of greatest concern to turbine engine combustion are the aromatic content, the distillation curve, and the viscosity. Fuel bound nitrogen is one new property which has emerged from the use of syncrude fuels because of additional NOx found in the exhaust. GRA

N78-30260# Energy Research and Development Administration, Bartlesville, Okla. Energy Research Center.
NEW LOOK AT ODORIZATION LEVELS FOR PROPANE GAS
M. L. Whisman, J. W. Goetzinger, F. O. Cotton, D. W. Brinkman, and C. J. Thompson Sep. 1977 97 p refs
(BERC/RI-77/1) Avail: NTIS HC A05/MF A01

The classical testing technique and three modified test modes were used to represent a spectrum of conditions that would define the effect of environmental familiarity and mental distractions upon olfactory responses, to LP-gas. Significant efforts were directed toward determination of odorant levels that not only can be detected but also will be detected. It is shown that in addition to defects of the nasal anatomy, psychological factors also affect olfactory responses, and that unfamiliarity with a given environment as well as anxieties or mental distractions can produce reduced awareness to odorants intended to warn individuals of the presence of LP-gas. Equilibrium K-values for both ethyl mercaptan and thiophane at three temperatures were determined. Novel sample handling and gas chromatographic techniques provided reproducible results which were in close agreement with theoretical predictions. ERA

N78-30261# Sandia Labs., Albuquerque, N. Mex.
STUDY OF THE PRODUCTION OF SHALE OIL FROM OIL SHALE IN WUERTEMBERG Final Report
Frank H. Reed May 1977 93 p Transl. into ENGLISH of German report FIAT-447, 31 Oct. 1945 Sponsored by DOE
(SAND-77-6014) Avail: NTIS HC A05/MF A01

The geology of the Wurtemburg oil shale deposits is described and development of oil shale processing plants during World War in that area is reviewed. It is noted that of ten planned plants four were producing at the time of allied occupation. Experimental underground distillation of oil shale near Schorzingen is described. Test results showed that it is possible to distill Pasidonia oil shale underground. Underground distillation experiments are described in which the effects of distillation chamber cross section were evaluated. In experiments conducted to evaluate underground oil shale distillation in very large chambers are detailed. ERA

N78-30262# Brookhaven National Lab., Upton, N. Y.
FUSION REACTORS-HIGH TEMPERATURE ELECTROLYSIS (HTE)
J. A. Fillo, ed. Jan. 1978 133 p
(Contract EY-76-C-02-0016)
(COO/0016-01) Avail: NTIS HC A07/MF A01

A reference design for synfuel production based on fusion reactors is discussed. High-temperature electrolysis (HTE) has the highest potential efficiency for production of synfuels from fusion; a fusion to hydrogen energy efficiency of about 70%

appears possible with 1800 C HTE units and 60% power cycle efficiency; an power cycle efficiency. While design efforts are required, HTE units offer the potential to be quickly run in reverse as fuel cells to produce electricity for restart of Tokamaks and/or provide spinning reserve for a grid system. The present reference design indicates that a 2000 MW(th) fusion reactor could produce as much at 364 million scf/day of hydrogen which is equivalent in heating value to 20,000 barrels/day gasoline. This would fuel about 500,000 autos based on average driving patterns. A factor of three reduction in coal feed (tons/day) could be achieved for syngas production if hydrogen from a fusion-HTE system were used to gasify coal, as compared to a conventional syngas plant using coal-derived hydrogen. ERA

N78-30263# Department of Energy, Oak Ridge, Tenn.
TESTS AT THE FOS TERMINAL ON THE LNG BEHAVIOR IN LARGE TANKS
Francois Bellus, Yves Reveillard, Christian Bonnaure, and Lucien Chevalier [1978] 16 p Transl. into ENGLISH from unidentified French report Sponsored by DOE
(DOE-TR-17) Avail: NTIS HC A02/MF A01

The determination of the recovery process of the evaporation gases of the LNG tanks and the setting of rational operating methods imply the exact knowledge of the LNG behavior during its storage. The theoretical studies carried out in this direction did not allow removing all the uncertainties so that tests were undertanken on both 35,000 cu m tanks at Fos in order to determine the evaporation rate at constant pressure of a tank for various liquid levels, the development of pressure in an entirely insulated tank, and the time taken for the return to the thermodynamic equilibrium of LNG when the operating pressure of the tank is suddenly changed. Results of simulated operation without recovery of the boiloff gases carried out on several tankers' journeys are presented. ERA

N78-30264# Parsons (Ralph M.) Co., Pasadena, Calif.
SCREENING EVALUATION: SYNTHETIC LIQUID FUELS MANUFACTURE Final Report
T. K. Chow and D. W. Stanbridge Aug. 1977 129 p refs Sponsored by EPRI
(EPRI-AF-523) Avail: NTIS HC A07/MF A01

Various available and proposed gasification processes in combination with one methanol process in conceptual commercial zie plant designs for production of clean liquid fuel from coal were compared. A Fischer-Tropsch liquids plant design was included for direct comparison with a methanol case using one gasification process. The results of this study indicate that there is an economic advantage to advanced gasification system for production of methanol. They also show that there is an economic advantage to production of methanol over that of Fischer-Tropsch liquids when the same type of gasifier is used in both plants. Author

N78-30265# California Univ., Livermore. Lawrence Livermore Lab.
METHANOL: A SELECTIVE CROSS-DISCIPLINARY BIBLIOGRAPHY
L. A. Green 31 Aug. 1977 31 p refs
(Contract W-7405-eng-48)
(UCRL-52332) Avail: NTIS HC A03/MF A01

This bibliography cites literature on methanol over such topic areas as biomedical effects, physical and technological effects, and environmental effects. More than 500 references, compiled from sources from 1965 to the present, are arranged in alphabetical order. ERA

N78-30266# Mound Lab., Miamisburg, Ohio.
MEASUREMENTS OF PRESSURE FOR THE TiH SUB x/KCIO4 SYSTEM
Clyde H. H. Chong and Jerome E. Glaub 10 Apr. 1978 18 p refs
(Contract EY-76-C-04-0053)
(MLM-2507) Avail: NTIS HC A02/MF A01

An investigation was conducted to measure the pressure obtained when the pyrotechnic mixture TiHx/KCIO4 was ignited in a confined variable volume system. It was possible to derive an expression of the form PV to the 7th power = k for the pressure-volume relationship obtained. This expression is a polytropic expansion of the ideal gas equation that best fits the data generated. For this particular work, values of gamma = 0.53 and k = 69.3 were obtained where P is in megapascals and V is in cubic centimeters. In addition, estimates of the reaction rates were calculated based on the times to achieve maximum pressure for a given volume system. An explicit expression relating rate to pressure was derived by a simplified least-squares fit of the data obtained. G.Y.

N78-30267# National Technical Information Service, Springfield, Va.
HYDROGEN STORAGE. PART 2: HYDROGEN AS A HYDRIDE. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1974 - May 1978
Diane M. Cavagnaro Jun. 1978 113 p Supersedes NTIS/PS-77/0496; NTIS/PS-76/0461
(NTIS/PS-78/0547/6; NTIS/PS-77/0496; NTIS/PS-76/0461) Avail: NTIS HC $28.00/MF $28.00 CSCL 21D

This bibliography contains 107 abstracts on hydrogen storage as a hydride. Citations discuss the chemical and physical properties of the hydride and how useful it will be for hydrogen storage. References also cover the conversion of hydrogen to a hydride and the conversion back to hydrogen. GRA

N78-30268# Economics, Statistics and Cooperatives Service, Washington, D. C.
GASOHOL FROM GRAIN: THE ECONOMIC ISSUES Final Report, 1977 - 1978
19 Jan. 1978 23 p refs Sponsored in part by Committee on the Budget (US House). Task force on physical resources
(PB-280120/7; ESCS-11; AGERSF-21) Avail: NTIS HC A02/MF A01 CSCL 21D

Proposals for using fermentation alcohol from grains as a motor fuel supplement are considered in economic feasibility. These proposals originate from the desire of farm groups to develop an added market for of grains and coincide with the Nation's desire to find alternatives to petroleum fuels. Results indicate a national program would require the production of 10 billion gallons of ethanol to mix with 90 billion gallons of gasoline to produce 100 billion gallons of gasohol annually.GRA

N78-30269# Systems Science and Software, La Jolla, Calif.
DEVELOPMENT OF NONPRIMARY-EXPLOSIVE LOW-VOLTAGE ELECTRIC DETONATOR FOR USE IN MINING OPERATIONS Final Report
P. B. Ritter and E. A. Day Jul. 1977 59 p refs
(Contract DI-BM-HO-366018)
(PB-280032/4; SSS-77-R-3148; BM-OFR-37-78) Avail: NTIS HC A04/MF A01 CSCL 08I

The feasibility of redesigning and adapting the all-secondary-explosive, low-voltage, electric safe detonator for use as a delay detonator was demonstrated. Operational characteristics were adjusted to allow direct competition of safe delay detonators with commercial delay blasting caps. Test results are given and results are evaluated. Subsequent simplified and improved designs for practical and economical mass production are described. Design concepts to meet Bureau of Mines voltage withstand, incendivity, and spark sensitivity requirements are included. Recommendations are made for experimental procedures to ready the safe delay detonator for mass production and extensive use in mining and other industries. GRA

N78-30270# National Technical Information Service, Springfield, Va.
HYDROGEN STORAGE. PART 1: STORAGE AS A GAS OR LIQUID. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1974 - May 1978
Diane M. Cavagnaro Jun. 1978 118 p Supersedes NTIS/PS-77/0495; NTIS/PS-76/0460
(NTIS/PS-78/0546/8; NTIS/PS-77/0495; NTIS/PS-76/0460) Avail: NTIS HC $28.00/MF $28.00 CSCL 21D

This bibiliography contains aspects of storing hydrogen as a liquid or a gas. Citations cover fuel storage, energy storage, and the construction of tanks used to store the material. GRA

N78-30321# California Univ., Livermore. Lawrence Livermore Lab
ALTERNATIVE FUELS UTILIZATION PROGRAM (AFUP) REASSESSMENT

Carl J. Anderson *In* DOE Highway Vehicle Systems Mar. 1978 p 305-311 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

N78-30322# Southwest Research Inst., San Antonio, Tex.
IDENTIFICATION OF PROBABLE AUTOMOTIVE FUELS COMPOSITION: 1985 - 2000
John A. Russel *In* DOE Highway Vehicle Systems Mar. 1978 p 311-333 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

N78-30323# Solar Turbines International, San Diego, Calif.
AUTOMOTIVE HYDROGEN STORAGE WITH MAGNESIUM HYDRIDE
D. A. Rohy *In* DOE Highway Vehicle Systems Mar. 1978 p 334-341 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

N78-30325# Escher Technology Associates, St. Johns, Mich.
ALTERNATIVE FUELS FOR INTERCITY TRUCKING SYSTEMS
William J. D. Escher *In* DOE Highway Vehicle Systems Mar. 1978 p 350-352 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

N78-30326# Department of Energy, Bartlesville, Okla. Energy Research Center.
NON-PETROLEUM FUELS AND COMPATIBLE ENGINES: 1977 BERC UP-DATE REPORT
R. W. Hurn *In its* Highway Vehicle Systems Mar. 1978 p 352-362 refs (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

N78-30327# Miami Univ., Fla.
ALCOHOL/GASOLINE BLENDS: LEAN MISFIRE LIMITS
Robert R. Adt, Jr. *In* DOE Highway Vehicle Systems Mar. 1978 p 362-365 refs (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

N78-30328# Santa Clara Univ., Calif.
METHANOL UTILIZATION
Richard Pefley *In* DOE Highway Vehicle Systems Mar. 1978 p 365-376 refs (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

N78-30331# Union Oil Co. of California, Los Angeles.
SOLVING ALCOHOL FUEL PROBLEMS BY FUEL MODIFICATION
James L. Keller *In* DOE Highway Vehicle Systems Mar. 1978 p 397-407 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

N78-30386# Transport and Road Research Lab., Crowthorne (England).
ENERGY FOR ROAD TRANSPORT IN THE UNITED KINGDOM
J. Porter *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 681-685 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30389# Wayne State Univ., Detroit, Mich.
FLAME SPEEDS, PERFORMANCE, AND EMISSIONS WITH METHANOL-INDOLENE BLENDS
Naeim I. Henein *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 697-706 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30391# Volkswagen A.G., Wolfsburg (West Germany).
RECENT PROGRESS IN AUTOMOTIVE ALCOHOL FUEL APPLICATION
Holger K. Menrad *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 712-727 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30392# Research Inst. for Road Vehicles, TNO, Delft (Netherlands).
ALTERNATIVE FUELS WITH REGARD TO LPG AND METHANOL
J. VanDerWeide *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 727-730 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30393# Miami Univ., Coral Gables, Fla.
THE EFFECT OF BLENDING METHANOL WITH GASOLINE ON GEOMETRIC DISTRIBUTION
R. R. Adt *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 730-732 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30394# Energy Research and Development Administration, Bartlesville, Okla. Energy Research Center.
ALTERNATIVE FUELS: THE OUTLOOK AND OPTIONS WITHIN THE NEXT DECADE
R. W. Hurn *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 732-735 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30395# General Motors Research Labs., Warren, Mich.
VEHICLE EVALUATION OF NEAT METHANOL: COMPROMISES AMONG EXHAUST EMISSIONS, FUEL ECONOMY, AND DRIVEABILITY
N. D. Brinkman *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 736-738 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30396# General Motors Research Labs., Warren, Mich.
EVALUATION OF ACETYLENE AS A SPARK IGNITION ENGINE FUEL
D. L. Hilden *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 738 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30397# Stevens Inst. of Tech., Hoboken, N. J.
THE PERFORMANCE OF HYDROGEN-FUELED RECIPROCATING ENGINES
R. B. Cole *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 739-740 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30400# Toyota Motor Co., Tokyo (Japan).
A STUDY ON REFORMED FUEL FOR AN AUTOMOTIVE GASOLINE ENGINE
K. Onoda *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 759-768 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30403# Billings Energy Research Corp., Provo, Utah.
REFUELING HYDROGEN TRANSIT FLEETS, PART B: DATA
R. B. Beyer *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 784-789 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30404# Mueller Associates, Inc., Baltimore, Md.
ALCOHOLS AND GASEOUS FUELS FROM BIOMASS
P. W. McCallum *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 789-795 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N78-30271 Aeronautical Research Labs., Melbourne (Australia).
AIRCRAFT STRUCTURAL FATIGUE
Apr. 1977 504 p refs Proc. held in Melbourne, 19-20 Oct. 1976
(ARL/Struc-Rept-363; ARL/Mat-Rept-104; AR-000-724)
Copyright. Avail: Issuing Activity

The assessment of structural fatigue is discussed in terms of ensuring safe fatigue lives for aircraft structures and components. Fundamentals of fatigue and of fracture mechanics, data acquisition and interpretation, and structural life prediction are included along with current research and development in structural and materials fatigue. For individual titles, see N78-30272 through N78-30290.

N78-30272 Aeronautical Research Labs., Melbourne (Australia).
SAFETY AGAINST FATIGUE IN FLIGHT: A PERSPECTIVE OF AUSTRALIAN EXPERIENCE AND RESEARCH **c05**
F. H. Hooke *In its* Aircraft Structural Fatigue Apr. 1974 p 5-22 refs (For primary document see N78-30271 21-31)
Copyright. Avail: Issuing Activity

Research efforts in aircraft structures and materials to reduce metal fatigue and improve aircraft safety are reviewed. Endurance of structures and materials, the loading actions on the structure, and inspection methods to maintain structural integrity are among the factors discussed. J.M.S.

N78-30273 Aeronautical Research Labs., Melbourne (Australia).
MECHANISMS OF FATIGUE AND FRACTURE **c39**
S. P. Lynch *In its* Aircraft Structural Fatigue Apr. 1977 p 25-55 refs (For primary document see N78-30271 21-31)
Copyright. Avail: Issuing Activity

Overload fracture, liquid-metal embrittlement, stress corrosion cracking, fatigue crack initiation, fatigue crack growth and corrosion fatigue are discussed and related. Observations suggest that crack growth in many metallic materials generally occurs by plastic flow and that fracture characteristics are determined mainly by the distribution of slip around crack tips. This distribution governs ductile versus brittle behavior and is influenced by microstructure, stress intensity, temperature, and environment; the effects of environment are attributed mainly to chemisorption at crack tips and are discussed in some detail. Changes in microstructure induced by cyclic stress, and the association of such changes with initiation and growth of fatigue cracks, are also examined. Relationships between crack growth rates and stress intensity factors, and the application of mechanistic understanding are then briefly discussed. J.M.S.

N78-30274 Aeronautical Research Labs., Melbourne (Australia).
FRACTURE MECHANICS FUNDAMENTALS WITH REFERENCE TO AIRCRAFT STRUCTURAL APPLICATIONS **c05**
B. C. Hoskin *In its* Aircraft Structural Fatigue Apr. 1977 p 57-89 refs (For primary document see N78-30271 21-31)
Copyright. Avail: Issuing Activity

Fracture mechanics and its applications to problems associated with cracked, or potentially cracked, aircraft structures is considered. Such applications include assessment of the residual strength of cracked components and also the prediction of fatigue crack growth. Limitations of fracture mechanics likely to be of importance in aircraft structural applications are emphasized. J.M.S.

N78-30275 Aeronautical Research Labs., Melbourne (Australia).
FLIGHT LOAD RESEARCH AT ARL **c05**
A. K. Patterson and C. K. Rider *In its* Aircraft Structural Fatigue Apr. 1977 p 93-101 refs (For primary document see N78-30271 21-31)
Copyright. Avail: Issuing Activity

Progress in obtaining flight load statistics for fatigue life estimation and the measurement of stress distribution using specially instrumented research flight aircraft is discussed. J.M.S.

N78-30276 Aeronautical Research Labs., Melbourne (Australia).
GUST MEASUREMENTS AND THE N SUB o PROBLEM **c08**
Douglas John Sherman *In its* Aircraft Structural Fatigue Apr. 1977 p 103-135 refs (For primary document see N78-30271 21-31)
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The problem of interpreting level crossing counts superimposed on a lesser number of large fluctuations is considered. It is shown that if fluctuations smaller than some specified amount are removed from a time history, the number of level crossings is reduced. An empirical formula is given for the amount of the reduction in a time series of atmospheric turbulence velocities. J.M.S.

N78-30277 Aeronautical Research Labs., Melbourne (Australia).
DEVELOPMENT OF A LOAD SEQUENCE FOR A STRUCTURAL FATIGUE TEST **c05**
P. J. Howard *In its* Aircraft Structural Fatigue Apr. 1977 p 137-148 refs (For primary document see N78-30271 21-31)
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A method for generating a load sequence for a structural fatigue test is described, and is illustrated by reference to the Mirage wing fatigue test. Flight sequence and load spectra for this test were defined by fatigue meter data, and within-flight maneuver loead sequences were derived from recorded time histories. J.M.S.

N78-30278 Aeronautical Research Labs., Melbourne (Australia).
FATIGUE S/N DATA IN RELATION TO VARIABILITY IN PREDICTED LIFE **c39**
J. M. Finney and J. Y. Mann *In its* Aircraft Structural Fatigue Apr. 1977 p 149-178 refs (For primary document see N78-30271 21-31)
Copyright. Avail: Issuing Activity

The variability which may arise from either fitting a mean curve to a given set of fatigue stress and cycles to failure (S/N) data points or from sources affecting the data points themselves was investigated. Mean lives to failure were predicted S/N curves for several multi-load-level spectra. The range of values of predicted life, from the largest to the smallest, and averaged over the several spectra, was 3:1 for one set of data points and 2x4:1 for the other set. Five mathematical methods of curve fitting were applied to one set of data points, with the resultant average range in predicted life being 1x4:1. This variability arises mainly from the subjective choice of a functional form for the S/N curve. The added variability due to other arbitrarily-chosen constraints such as weighting, the nonintersection of curves within a family, and the choice of a fatigue limit, is also discussed. Many factors associated with the determination of fatigue data influence the resultant S/N relationship and some of the more significant ones are considered. Those factors examined include the loading accuracy of the testing machine, specimen manufacturing methods and the number of specimens tested, the definition of fatigue failure, variability between batches. J.M.S.

N78-30279 Aeronautical Research Labs., Melbourne (Australia).
STRUCTURAL FATIGUE TESTING **c39**
R. A. Bruton and C. A. Patching *In its* Aircraft Structural Fatigue Apr. 1977 p 179-202 refs (For primary document see N78-30271 21-31)
Copyright. Avail: Issuing Activity

The various testing techniques available, selection of the test article, data obtainable from fatigue testing of components, assemblies and complete structures, and the conclusions that have been reached based on experience from a large number of fatigue tests on aircraft wings are discussed. J.M.S.

N78-30280 Aeronautical Research Labs., Melbourne (Australia).
CURRENT DEVELOPMENTS IN THE LIFE OF AIRCRAFT STRUCTURE **c39**
A. O. Payne *In its* Aircraft Structural Fatigue Apr. 1977 p 205-226 refs (For primary document see N78-30271 21-31)
Copyright. Avail: Issuing Activity

Procedures for fatigue design and fatigue life estimation, substantiation, and monitoring of aircraft structures are reviewed. Major gaps in the present state of knowledge are identified and further research directed towards filling these gaps is

discussed. It is shown that the fatigue assessment of modern aircraft structures is a very complex problem for which no general method of solution has yet been established despite the extensive research programs being conducted. A trend toward examining various aspects of fatigue behavior to find increasing application is documented. J.M.S.

N78-30281 Aeronautical Research Labs., Melbourne (Australia).
AIRCRAFT STRUCTURAL LIFE MONITORING AND THE PROBLEM OF CORROSION **c26**
L. M. Bland *In its* Aircraft Structural Fatigue Apr. 1977 p 227-253 refs (For primary document see N78-30271 21-31)
Copyright. Avail: Issuing Activity

The principles of fatigue design, and related structural maintenance, are briefly described for two essentially different philosophies of structural fatigue life. In once case, it is assumed that no crack is present in any structural component at the beginning of service and that the components should remain crack-free throughout the service life. In the other case, it is conservatively assumed that cracks are present in all components which service beings but that these cracks, growing slowly, can be tolerated for the required service life. The relevance of the chemical and physical environment in which the structure exists is discussed for the two cases. The role of structural service monitoring in ensuring safe and economic operation of aircraft is considered and the place of environment and corrosion monitoring in the general monitoring scheme is identified. The importance of nondestructive inspection in corrosion monitoring is also considered, with an assessment of the applicability and adequacy of various inspection methods in the monitoring task. Indications are given of the limitations of these methods and of the requirements for improved planning of the corrosion monitoring process. J.M.S.

N78-30282 Aeronautical Research Labs., Melbourne (Australia).
NDI AND THE DETECTION OF FATIGUE **c38**
I. G. Scott *In its* Aircraft Structural Fatigue Apr. 1977 p 255-267 refs (For primary document see N78-30271 21-31)
Copyright. Avail: Issuing Activity

The problems of monitoring fatigue cracks by nondestructive inspection (NDI) are discussed and recent developments in the methods and techniques are reviewed. Three aspects are considered in some detail: (1) the part played by the operator in NDI; (2) applications of acoustic emission to fatigue studies; and (3) future trends in NDI. Some new philosophies fatigue testing are also considered. J.M.S.

N78-30283 Aeronautical Research Labs., Melbourne (Australia).
THE DEVELOPMENT OF THE THEORY OF STRUCTURAL FATIGUE **c39**
D. G. Ford *In its* Aircraft Structural Fatigue Apr. 1977 p 269-298 refs (For primary document see N78-30271 21-31)
Copyright. Avail: Issuing Activity

The relation of structural fatigue to other branches of fatigue is outlined by a brief historical survey which includes the main ideas of the theory and ends with some of the current problems and possible developments. Cumulative damage and reliability are included. J.M.S.

N78-30284 Aeronautical Research Labs., Melbourne (Australia).
AIRCRAFT STRUCTURAL RELIABILITY AND RISK THEORY: A REVIEW **c38**
F. H. Hooke *In its* Aircraft Structural Fatigue Apr. 1977 p 299-344 refs (For primary document see N78-30271 21-31)
Copyright. Avail: Issuing Activity

Evaluation of the structural reliability and probability of failure during the lifetime, a statistical exercise based upon load history data and strength decay properties known or attributed to the structures in question, are discussed. Reliability of reliability estimates is examined, and is shown to be usually limited by sampling problems and arbitrary judgments concerning the attribution of properties to the population in question. The estimates are compared with those derived by semiprobabilistic or limit analysis methods. J.M.S.

N78-30285 Aeronautical Research Labs., Melbourne (Australia).
LOAD INTERACTION EFFECTS IN FATIGUE CRACK PROPAGATION **c39**
G. W. Revill, Ningaiah, and J. M. Finney *In its* Aircraft Structural Fatigue Apr. 1977 p 347-372 refs (For primary document see N78-30271 21-31)
Copyright. Avail: Issuing Activity

Some experiments on the influence of material thickness are described. For 2024-T3 aluminum alloy specimens the delay in crack growth caused by a single overload was greater by a factor of about 8.5 for 1.6 mm thick specimens than for 6.4 mm thick specimens. The practical importance of this effect is emphasized. Various proposed mechanisms of load interaction are described as well as models for quantitative predictions. The models all incorporate the extent of crack tip plasticity into the Paris formulation of fatigue crack growth. They do not accurately detail the course of crack growth through the interaction period. It is concluded that satisfactory prediction of interaction effects will require some materials information, obtainable only by test. J.M.S.

N78-30286 Aeronautical Research Labs., Melbourne (Australia).
A MODEL OF CRACK-TIP BEHAVIOUR FOR FATIGUE LIFE DETERMINATION **c39**
F. P. Bullen, J. A. Retchford, C. B. Rogers, and B. J. Wicks *In its* Aircraft Structural Fatigue Apr. 1977 p 373-391 refs (For primary document see N78-30271 21-31)
Copyright. Avail: Issuing Activity

The evaluation of fatigue life by simulating the performance of critically stressed areas of a structure using individual tests on small specimens is considered. The experiments which are presented have been carried out on polycrystalline copper, since the physical basis of crack tip behavior in this simple metal is also applicable to conventional aircraft materials. It is shown that, in these materials, cracks propagate under cyclic loading as a result of irreversible plastic strain, and a parameter describing the plastic strain at the crack tip is defined which is shown to be directly related to the rate of crack propagation. A simple model of crack tip behavior is proposed, in which the elastic and plastic contributions from material around the crack tip can be isolated and recombined in varying proportions. This could allow the behavior of a cracked component in a structure to be replicated on small cracked specimens, by superimposing on the specimen load spectrum a stress variation representing the effect at the crack tip, of the elastically deforming structure. The model is validated under a wide range of load histories and the implications for practical aircraft materials are discussed. J.M.S.

N78-30287 Aeronautical Research Labs., Melbourne (Australia).
FATIGUE-CRACK GROWTH AND FRACTURE IN D6AC STEEL **c39**
N. E. Ryan *In its* Aircraft Structural Fatigue Apr. 1977 p 393-418 refs (For primary document see N78-30271 21-31)
Copyright. Avail: Issuing Activity

It is shown that fatigue crack growth rates are independent of tensile strength and fracture toughness. The observations are interpreted in terms of the effects of variations of microstructure on deformation and fracture mechanisms. Variable amplitude loading showed no transient effects after load changes. Environmental factors were also studied and it was concluded that simple additivity of fatigue and stress corrosion could not be used to account for crack growth rates under corrosive environments. Various laws, developed from fracture mechanics concepts to express crack growth rates on a function of stress intensity amplitudes, are discussed. J.M.S.

N78-30288 Aeronautical Research Labs., Melbourne (Australia).
FIBRE COMPOSITE REINFORCEMENT OF CRACKED AIRCRAFT STRUCTURES **c24**
A. A. Baker and M. M. Hutchison *In its* Aircraft Structural Fatigue Apr. 1977 p 419-457 refs (For primary document see N78-30271 21-31)
Copyright. Avail: Issuing Activity

The fatigue performance of a range of commercially available adhesive materials was examined to enable the selection of an adhesive system suitable for bonding of fiber composite reinforcements to cracked aircraft structures. Small constant stress cantilever 7075-T6 aluminum alloy fatigue specimens were used to evaluate the characteristics of the adhesives and also to examine the feasibility of using fiber composites to control crack propagation. The adhesive selected for the repair application

required curing at 130 C which, due to the low thermal expansion of the composite, induced residual tensile stresses in the aluminum at room temperature. Wedge-loaded, precracked stress corrosion specimens were used to show that these internal stresses do not significantly limit the practical usefulness of the proposed repair schemes. Finally, two practical aircraft repairs are described which are currently being evaluated under operating conditions.
J.M.S.

N78-30289 Aeronautical Research Labs., Melbourne (Australia).
THE INFLUENCE OF THE WATER VAPOUR CONTENT AND THE TEMPERATURE OF AN AIR ENVIRONMENT ON THE FATIGUE BEHAVIOR OF SAE 4340 STEEL **c26**
D. S. Kemsley *In its* Aircraft Structural Fatigue Apr. 1977 p 459-477 refs (For primary document see N78-30271 21-31)
Copyright. Avail: Issuing Activity

Total fatigue lives, fatigue crack initiation and propagation lives, and fatigue crack propagation rates of notched SAE 4340 steel specimens under program loading were determined in air environments having 45 different water vapor content/temperature combinations. Forty-three of these involved unsaturated (less than 100% relative humidity (RH)) conditions. The maxima in total life and initiation and propagation lives, and the minimum crack propagation rate, did not occur in very dry air, but at 3% to 50% RH at 100 C to 40 C respectively. As the temperature of air of constant water vapor content is lowered, and the conditions change from an unsaturated to a saturated environment, a marked reduction in fatigue life occurs. This is due to the combination of a decrease in crack initiation life and a large increase in the rate of crack propagation. These effects may be interpreted as being due to the production of various hydrogen contents in the specimens because of the various environments, and consequently as differences in the fatigue behavior of various SAE 4340/hydrogen 'alloys'. The bearing of the results on the common concepts of 'corrosion fatigue' and 'atmospheric corrosion fatigue' is discussed. J.M.S.

N78-30290 Aeronautical Research Labs., Melbourne (Australia).
THE USE OF ADHERENT ALUMINUM FOILS FOR FATIGUE METERING **c26**
R. A. Coyle and M. E. Packer *In its* Aircraft Structural Fatigue Apr. 1977 p 479-497 refs (For primary document see N78-30271 21-31)
Copyright. Avail: Issuing Activity

Aluminum foils attached to fatigue specimens show an increase of intensity of the 511,333 X-ray diffraction line as a result of cycling and the increase is shown to arise from changes in texture. It is confirmed that this phenomenon can be used as the basis of a fatigue meter in certain situations. However, it is unlikely to be of general use in the aeronautical field because of its insensitivity to repeated-tension cycles. J.M.S.

N78-30291*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL DETERMINATION OF THE RATTLE OF SIMPLE MODELS
Clevenson A. Sherman Jul. 1978 22 p refs
(NASA-TM-78756) Avail: NTIS HC A02/MF A01 CSCL 20K

The effect of the excitation frequency on the rattle boundaries of simple models was investigated. The frequency range investigated was from 40 to 4,000 Hz. A 1-inch steel ball was studied to determine the rattle boundary for both vertical motion and for the ball suspended as a pendulum. Effects of surface contact and weight were also studied. Results indicate that the shape of the rattle boundary depends on the particular configuration being investigated as well as the range of frequency being investigated. Although there was condiderable scatter in the data, the general trend indicates that the level of acceleration required for the onset of rattle was independent of excitation frequency.
S.E.S.

N78-30292# Magnetic Technology, Canoga Park, Calif.
REPORT OF TEST ON CRYOGENIC COOLER MOTORS Final Test Report, Dec. 1974 - Oct. 1977
Raymond D. Lathrop, W. S. Osborne, and K. W. Korf 6 Oct. 1977 50 p
(Contract DAAK02-75-C-0065)
(AD-A054275; Rept-50285-5) Avail: NTIS HC A03/MF A01 CSCL 09/1

This document provides test data obtained from twelve prototype DC brushless outer rotation motors designed to operate at 20 oz in and 1100 RPM. Power input, speed-torque, and efficiency curves are provided for ambient temperatures between -54C to 82C and for applied input voltages from 18 to 32 VDC.
Author (GRA)

N78-30293# Department of Energy, Washington, D. C. Transportation Energy Conservation Div.
HIGHWAY VEHICLE SYSTEMS Summary Report no. 13
Mar. 1978 451 p refs Presented at the 13th Contractors Coord. Meeting, Dearburn, Mich., 4-6 Oct. 1977
(CONF-771037) Avail: NTIS HC A20/MF A01

Various types of automobile engines were evaluated for economy in fuel consumption. Engine designs and components were specified. Alternate types of fuels were also considered. For individual titles, see N78-30294 through N78-30331.

N78-30294*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
REVIEW OF JPL AUTOMOTIVE TECHNOLOGY STATUS AND PROJECTIONS (ATSP) PROJECT **c37**
Mack W. Dowdy *In* DOE Highway Vehicle Systems Mar. 1978 p 17-27 ref (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

The general objective was to make a continuing assessment of current automotive technology development programs and of the prospects for new concepts. The study embraced alternative engines, advanced powertrain components, and related energy conserving vehicle modifications which could be implemented by the end of this century. Vehicle level projections of the fuel economy and emissions potential of alternative power systems were key elements of this assessment. J.A.M.

N78-30295*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VEEP: A VEHICLE ECONOMY, EMISSIONS, AND PERFORMANCE SIMULATION PROGRAM **c37**
Gerhard J. Klose *In* DOE Highway Vehicle Systems Mar. 1978 p 28-31 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

The purpose of the VEEP simulation program was to: (1) predict vehicle fuel economy and relative emissions over any specified driving cycle; (2) calculate various measures of vehicle performance (acceleration, passing manuevers, gradeability, top speed), and (3) give information on the various categories of energy dissipation (rolling friction, aerodynamics, accessories, inertial effects, component inefficiences, etc.). The vehicle is described based on detailed subsystem information and numerical parameters characterizing the components of a wide variety of self-propelled vehicles. Conventionally arranged heat engine powered automobiles were emphasized, but with consideration in the design toward the requirement of other types of vehicles.
J.A.M.

N78-30296# Postal Service, Washington, D. C.
USPS LIGHT DELIVERY VEHICLES PROGRAM **c37**
Wilson E. Hull *In* DOE Highway Vehicle Systems Mar. 1978 p 31-39 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

The U.S. Postal Service program for examining various types of vehicles is reviewed. The diesel engine obtained about 122 percent more miles per gallon during operation use than the gasoline engine under the same conditions. The gasoline engine that was tested was larger than the diesel engine. The various development efforts include: (1) conversion, test, and evaluation of diesels, (2) evaluation of stratified charge engines, (3) evaluation of hydrogen fuel energy sources both liquid and metal hydride, (4) development of electric vehicles, and (5) development of the electric flywheel system. J.A.M.

N78-30297# Borg-Warner Corp., Chicago, Ill. Morse Chain Div.
DOE/GSA MICROFLEET EVALUATION OF THE MORSE CONTROL SPEED ACCESSORY DRIVE **c37**
C. Wollard *In* DOE Highway Vehicle Systems Mar. 1978 p 40-51 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

The engine unit depicted is being currently downsized to fit a greater number of applications, since the trend is toward V-6 and V-4 cylinder in-line engines as standard equipment. These engines generally have shorter crankshaft to water pump distances than a V-8 engine. Federal damagability standards limit the proximity of the cooling fan to the radiator. It is the space between the fan and the accessory v-belt lines into which a variable ratio belt and pulleys must fit. This space must be approximately 1-1/8 inch consisting of the top width of the main belt itself, the belt's axial travel, the pulley halves' wall thicknesses, and their clearance from the accessory v-belts. J.A.M.

N78-30298# Thermo Electron Corp., Waltham, Mass.
ORGANIC RANKINE BOTTOMING CYCLE FOR LONG HAUL DIESEL TRUCKS **c37**
Robert Raymond *In* DOE Highway Vehicle Systems Mar. 1978 p 52-67 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

The organic Rankine bottoming cycle, due to its relatively high cycle efficiency at moderate peak cycle temperatures of 550 F to 650 F offered the best potential for converting waste energy to usable shaft power. The organic Rankine bottoming cycle was considered for various automobile and truck applications. The heavy duty diesel trucks were considered ideal for Rankine cycle, because the engine load and speed requirements are nearly constant over a large portion of the operating hours, and high mileages were accumulated. Tests were conducted with a Mack 676 diesel engine and an organic Rankine bottoming cycle. At the peak power condition, 36 additional horsepower were produced, a gain of 13 percent in power without additional fuel. J.A.M.

N78-30299# Sandia Labs., Albuquerque, N. Mex.
SUMMARY OF VARIABLE DISPLACEMENT ENGINE PROJECT **c37**
C. W. Robinson *In* DOE Highway Vehicle Systems Mar. 1978 p 67-73 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

A variable displacement, five cylinder, spark ignition research engine was designed, fabricated, and tested. This design reduced partial load fuel consumption by reducing throttling and friction losses. Power was controlled by changing the piston stroke rather than by throttling, except at idle and very low power levels. A linkage arrangement allowed for continuous changes in stroke and, therefore, in engine displacement. The prototype has a bore of 3.375 inches, and stroke varies from 1 to 4-1/4 inches as displacement varies from 43 to 190 cubic inches. The linkage concept was such that, clearance volume could be changed in proportion to the stroke. Nearly constant compression ratio could be achieved, or (by proper selection of the linkage dimensions) compression ratio could be tailored to optimize the design. J.A.M.

N78-30300# Orshansky Transmission Corp., New York.
HYDRO-MECHANICAL TRANSMISSION DEVELOPMENT FOR PASSENGER CAR FUEL ECONOMY **c37**
Peter Huntley *In* DOE Highway Vehicle Systems Mar. 1978 p 73-93 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

A continuously variable transmission is being developed for application to automobiles. The transmission is of the hydromechanical type, in which the power is split between a gear train and a speed-changing component consisting of a variable displacement hydrostatic pump and motor. In-vehicle transmission testing has proceeded far enough to confirm the availability of a 20 percent fuel economy improvement. In addition to chassis dynamometer testing, considerable effort is being devoted to upgrading the driveability, and several transmission control features were modified to improve smoothness of clutch shifting, stability of engine speed, and the minimization of engine speed error. In view of the penalties in both fuel economy and wide-open-throttle acceleration associated with errors in the engine speed, improvements in transmission control are having a direct impact on both measures of vehicle performance. J.A.M.

N78-30301# Mechanical Technology, Inc., Latham, N. Y.
DEMONSTRATION OF HYDRAULIC MODULE FOR AN AUTOMOTIVE HYDROMECHANICAL TRANSMISSION **c37**
Paul Lewis *In* DOE Highway Vehicle Systems Mar. 1978 p 94-101 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

The engine configuration used a hydrostatic module arranged in a tandem axial relationship with output planetary gearing. The modular hydrostatic construction provided direct connection to the engine input, and the gearing permitted effective noise isolation and had minimum structural requirements. The configuration was attractive in that it used a proven control system, conventional automotive design, and was compatible in size (envelop), weight, and cost with current transmissions. The fuel economy gain came from the improved engine efficiency achieved through use of the CVT. The CVT has the speed and torque capability to allow the engine to operate close to the minimum SFC while delivering the required road load. J.A.M.

N78-30302# AiResearch Mfg. Co., Phoenix, Ariz.
IMPROVING AUTOMOBILE FUEL ECONOMY WITH ACCESSORY DRIVES **c37**
C. H. Lefferts *In* DOE Highway Vehicle Systems Mar. 1978 p 101-124 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

The major program effort produced a variable ratio belt accessory drive and demonstrated performance and fuel economy potential of the constant speed principle. The EPA composite driving cycle fuel economy was improved by 4.8 percent. Installation of the drive system permitted cost effective accessory array redesign and improved load matching. Vehicle and accessory performance emissions, noise, and accessory life were also improved. J.A.M.

N78-30303*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GAS TURBINE PROJECT STATUS **c37**
W. E. Goette *In* DOE Highway Vehicle Systems Mar. 1978 p 125-129 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01 CSCL 21A

The state-of-the-art of automobile gas turbine technology, particularly with respect to fuel economy and emissions, was defined. An advanced gas turbine system is proposed which incorporates significant advances in technology, and has a fifty to sixty percent gain in fuel economy over the spark ignition engine, while meeting the same goals of the improved gas turbine engine. J.A.M.

N78-30304# Chrysler Corp., Detroit, Mich.
STATUS OF THE CHRYSLER UPGRADED GAS TURBINE ENGINE PROGRAM **c37**
C. E. Wagner *In* DOE Highway Vehicle Systems Mar. 1978 p 129-142 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

The program is currently utilizing five engines. Three are being used in test cells for engine development, two at Chrysler and one at NASA; and two are installed in vehicles. Of the two engines still to be built, one will be instrumented for development toward minimizing bulkhead cooling and the other will be for a third car. Although no formal endurance effort was undertaken, 600 hours of accumulated testing have revealed no significant mechanical problems. Of the two running vehicles, one is being used principally for exhibit and the other for control and general vehicle system development. Contraints were eased to allow designs which should eliminate the present 25 percent power shortfall. J.A.M.

N78-30305*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LEWIS RESEARCH CENTER SUPPORT OF CHRYSLER UPGRADED ENGINE PROGRAM **c37**
E. L. Warren *In* DOE Highway Vehicle Systems Mar. 1978 p 143-149 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01 CSCL 21A

Running of the upgraded engine has indicated that, although the engine is mechanically sound, it is deficient in power. Recent modifications and corrective action have improved this. Testing of the engine is being done in the test cell. This simulates an

automobile installation. Located in the inlet flow ducts are two turbine flow meters to measure engine air flow. J.A.M.

N78-30306# General Motors Corp., Detroit, Mich.
IMPROVED HEAVY DUTY GAS TURBINE ENGINE PROGRAM **c37**
H. E. Helms and Franklin A. Rockwood *In* DOE Highway Vehicle Systems Mar. 1978 p 149-164 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

Ceramic components were tested on a baseline engine for initial ceramic regenerator disk chemical stability evaluation. The baseline engine testing was accomplished at regenerator inlet temperatures of 1425 - 1450 F; 1800 hours of accumulated engine test time has shown chemical stability of aluminum silicate, heavy wall, regenerator disks. J.A.M.

N78-30307# Ford Motor Co., Dearborn, Mich.
STATUS OF FORD REGENERATOR SYSTEMS DEVELOPMENT **c37**
C. S. Rahnke *In* DOE Highway Vehicle Systems Mar. 1978 p 165-174 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

Data show that two material, AS and MAS, have the potential of achieving the program objective of a B10 life (10,000 hours at 800 C). To date, eight AS cores have accumulated over 4000 hours with three accumulating over 5000 hours. None of these cores show any serious signs of chemical attack. J.A.M.

N78-30308# Mechanical Technology, Inc., Latham, N. Y.
DEVELOPMENT OF COMPLIANT FOIL BEARINGS FOR AUTOMOTIVE GAS TURBINES **c37**
Stanley Gray *In* DOE Highway Vehicle Systems Mar. 1978 p 174-194 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

The 1-1/2 inch diameter bearing was developed and is being used in the engine program at 60,000 rpm and temperatures of 500-600 F; currently limited developmental work is continuing in which the main emphasis is on the long term reliability aspects of the bearing-rotor system and on delivery of engine bearings. J.A.M.

N78-30309# Ford Motor Co., Dearborn, Mich.
FABRICATION AND TESTING OF SILICON NITRIDE TURBINE ROTORS **c37**
D. L. Harstock *In* DOE Highway Vehicle Systems Mar. 1978 p 194-208 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

The most complex and highly stressed component is the duo-density turbine rotor. The high strength of hot pressed silicon nitride was used in the hub region where stresses were highest, but temperatures were moderate, and, therefore, creep resulting from the use of a magnesium densification additive was minimized. The blade ring was made from reaction bonded silicon nitride, which could be formed into complex airfoil shapes by injection molding or slip casting. Although the reaction bonded material was of lower density and, thus, lower strength, it was adequate for the turbine blades, since stress levels in this region were lower than in the hub, and particularly since the creep resistance of the reaction bonded material was superior, at high temperature, to that of the hot pressed silicon nitride. The hub was formed and bonded to the blade ring in one hot-pressing operation. J.A.M.

N78-30310# Army Materials and Mechanics Research Center, Watertown, Mass. Ceramics Research Div.
REVIEW OF DURABILITY TESTING OF STRUCTURAL CERAMICS **c27**
R. Nathan Katz *In* DOE Highway Vehicle Systems Mar. 1978 p 208-224 refs (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

Results of 1200 C stress-rupture testing of NC-132 is presented. The data imply a static fatigue limit of about 35 ksi. One specimen has survived without failure for 610 hours at about 34 ksi. The specimen showed a total permanent outer fiber strain of 1.4 percent. Results of stepped stress-rupture testing indicate time dependent failures at temperatures of 1100 C and above. J.A.M.

N78-30311# General Electric Co., Fairfield, Conn.
HEAT EXCHANGER MATERIALS BASED ON LITHIUM AND MAGNESIUM ALUMINUM SILICATES **c24**
Louis R. McCreight *In* DOE Highway Vehicle Systems Mar. 1978 p 224-225 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

The purpose of the program was to develop a ceramic material with appropriate physical and chemical properties suitable for application as a construction material for a heat exchanger in a vehicular gas turbine. The major requirements were low thermal expansion between ambient and 1000 C and the ability to operate at least for short times at temperatures up to 1100 C. To satisfy this goal, the materials should have strength, thermal expansion, thermal phase stability, and thermal shock resistance comparable to, or better than, current materials, but must have improved corrosion resistance. J.A.M.

N78-30312# Owens-Illinois, Inc., Toledo, Ohio.
IMPROVED HEAT EXCHANGER MATERIALS **c24**
Kenneth Kormanyos *In* DOE Highway Vehicle Systems Mar. 1978 p 225-238 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

Material C-144 was comparable to Corning 9460 AS. Both materials have excellent sulfuric acid resistance, but only fair sodium chloride resistance. All materials have an acceptable thermal expansion of less than 800 ppm Delta L/L change in length from ambient to 1000 C. Material C-144 had superior thermal expansion stability to 1100 C and 1200 C exposure compared to Corning 9460 AS. J.A.M.

N78-30313# Corning Glass Works, N.Y.
ALUMINOUS KEATITE AS A REGENERATOR MATERIAL (GUEST PRESENTATION) **c24**
John G. Lanning *In* DOE Highway Vehicle Systems Mar. 1978 p 238-240 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

Some comparative data on aluminous keatite material are presented. The key core material properties of the heavy walled T20-38 structure are shown at 0 hours and after 6935 hours of engine testing. Both of these matrices were produced about the same time. They are reasonably comparable. Thermal expansion is studied. A comparison of the thick and thin walled structures is shown. Attempts are made to increase the strength (Modulus of Rupture and Young's Modulus) of the thin walled structure so that the better heat transfer characteristics can be fully exploited. These differences in Modulus of Rupture and Young's Modulus cause the problem of mounting the elastomer bonded ring gear to the core. The present program is to improve the T14-20 strength so that higher thermal performance at part load can be achieved. The future success of ceramic regenerators is believed to depend on thin walled material. Effort is also directed toward increased matrix hardness and also increased operating temperature capability. L.S.

N78-30314*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STIRLING ENGINE PROJECT STATUS **c37**
R. G. Ragsdale *In* DOE Highway Vehicle Systems Mar. 1978 p 241-243 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01 CSCL 21A

The status of the Stirling project is summarized. Contract negotiations were completed with Ford Motor Company to carry out a major, cost-shared development program for an improved engine. A parallel, but independent, development activity by a second team is also planned. L.S.

N78-30315# Ford Motor Co., Dearborn, Mich.
IMPROVED STIRLING ENGINE DEVELOPMENT **c37**
Norman D. Postma *In* DOE Highway Vehicle Systems Mar. 1978 p 243-254 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

Specific data from the 170 HP test program are provided, some of the problems encountered are described, and the overall plan for continuance of the program under a cost-sharing contract with DOE and NASA is reviewed. L.S.

N78-30316*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

INITIAL TEST RESULTS WITH SINGLE CYLINDER RHOMBIC DRIVE STIRLING ENGINE **c37**

James E. Cairelli *In* DOE Highway Vehicle Systems Mar. 1978 p 254-258 (For primary document see N78-30293 21-31) Avail: NTIS HC A20/MF A01 CSCL 13I

A brief description is given of the GPU 3-2 hardware, the test methods used, and the result of these tests. Comparison is made to unpublished data from similar hydrogen tests performed by the U.S. Army. L.S.

N78-30317# Boeing Commercial Airplane Co., Seattle, Wash.

EVALUATION OF RECIPROCATING SEALS FOR STIRLING CYCLE ENGINE APPLICATION **c37**

Al W. Waterman *In* DOE Highway Vehicle Systems Mar. 1978 p 258-266 (For primary document see N78-30293 21-31) Avail: NTIS HC A20/MF A01

The technical effort is divided into the three units of work. The first of these is to conduct the analysis of prospective seals and to procure the necessary seals for test. During this effort, the designs of three seals were examined for material compatibility with the engine environment, adaptability of the geometry to compensate for wear, dimensional fit in standard glands, and experience demonstrated in similar environments. Two seals were selected as having the best potential for satisfying the rod seal requirements for the Stirling engine. One of these seals, the NASA polyimide chevron, requires the development of dimensions to fabricate a 7/8-inch rod size. L.S.

N78-30318*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

MATERIALS TECHNOLOGY ASSESSMENT FOR STIRLING ENGINES **c37**

Joseph R. Stephens *In* DOE Highway Vehicle Systems Mar. 1978 p 267-274 (For primary document see N78-30293 21-31) Avail: NTIS HC A20/MF A01 CSCL 21A

The objectives are to assess the current state-of-the-art of metals and ceramics that are potential candidate materials for hot components in the improved or advanced Stirling engines; identify materials research, development, and testing required to support the development of automotive Stirling engines; and recommend materials technology program plans to assure material readiness in time with the engine system development programs. L.S.

N78-30319# Washington Univ., Seattle.

SURVEY OF STIRLING ENGINE ANALYTICAL DESIGN METHODS **c37**

W. R. Martin *In* DOE Highway Vehicle Systems Mar. 1978 p 274-286 (For primary document see N78-30293 21-31) Avail: NTIS HC A20/MF A01

The essential character of a Stirling engine is explained and an appreciation of the three orders of Stirling engine design methods is given. The first order methods are useful for system studies. For already optimized engines, this method shows roughly how engine performance relates to operating conditions. The second order methods assume that relatively simple formulas can be used to compute the power output and the mechanical and thermal losses. This method is short enough to be used for design optimization of the engine. The third order methods employ rigorous nodal analysis of the actual engine process with few approximations. L.S.

N78-30320# Mechanical Technology, Inc., Latham, N. Y.

THERMAL ENERGY STORAGE/HEAT ENGINE FOR HIGHWAY VEHICLE PROPULSION **c37**

L. R. Folsom *In* DOE Highway Vehicle Systems Mar. 1978 p 286-303 refs (For primary document see N78-30293 21-31) Avail: NTIS HC A20/MF A01

The feasibility of the thermal energy storage/heat engine concept as an energy conversion system was demonstrated. The effectiveness of this system as an alternative to storage battery/electric motor for highway vehicle propulsion was not determined. The program involves system studies to assess the economic and technical feasibility of thermal energy storage (TES) for highway vehicle application. The thermal energy storage concept for highway vehicle propulsion uses a storage unit, a heat transfer device, a heat engine, and a power transmission/differential to drive the wheels. The concept should have inherent compatibility with any heat source that provides the required storage temperature, e.g., 1000K. Electric resistance, solar heating, and the combustion of a fuel are all possible. Once charged, the TES/heat engine propulsion system operates with zero exhaust emissions and with low noise. The Stirling cycle heat engine appears to be the best choice. L.S.

N78-30321# California Univ., Livermore. Lawrence Livermore Lab.

ALTERNATIVE FUELS UTILIZATION PROGRAM (AFUP) REASSESSMENT **c28**

Carl J. Anderson *In* DOE Highway Vehicle Systems Mar. 1978 p 305-311 (For primary document see N78-30293 21-31) Avail: NTIS HC A20/MF A01

Feasibility studies were made on what alternative fuels might be for the 1985-2000 time period. These studies were the corner stone of the program and subsequent activities. Ideas and philosophies were developed, along with the projects. A comprehensive review and assessment of the program was instituted. A very brief summary of this effort is presented here. L.S.

N78-30322# Southwest Research Inst., San Antonio, Tex.

IDENTIFICATION OF PROBABLE AUTOMOTIVE FUELS COMPOSITION: 1985 - 2000 **c28**

John A. Russel *In* DOE Highway Vehicle Systems Mar. 1978 p 311-333 (For primary document see N78-30293 21-31) Avail: NTIS HC A20/MF A01

Methodology is presented to be utilized in projecting most probable compositions of hydrocarbon and methanol automotive fuels, using domestic nonpetroleum resources (oil shale and coal) in their manufacture. Compositional factors are critically contingent upon syncrude conversion process parameters which require further development and definition. If the emerging syncrudes-synfuels industry develops at currently forseeable rates, such syncrudes will be blended with petroleum crudes in such a manner as to have no impact on conventional automotive fuels composition. L.S.

N78-30323# Solar Turbines International, San Diego, Calif.

AUTOMOTIVE HYDROGEN STORAGE WITH MAGNESIUM HYDRIDE **c28**

D. A. Rohy *In* DOE Highway Vehicle Systems Mar. 1978 p 334-341 (For primary document see N78-30293 21-31) Avail: NTIS HC A20/MF A01

From experimental data it can be seen that modified Mg-Ni alloys offer the greatest potential for reaching that goal. Dissociation temperature at one atmosphere hydrogen pressure is reduced to 204 C for an alloy of Mg, Ni, Cu, Si, and Y from 302 C for Mg0.9Ni0.1Hx. Nickel content has been reduced to 24 percent from 55 percent in Mg2NiHx. Dissociation temperatures as low as 223 C were achieved with alloys containing 10 percent nickel. Dissociation pressure, hydrogen capacity, kinetics, and safety are other hydride characteristics considered. Practical considerations of the cost, size, weight, fueling, and storage period of a hydride system with energy equivalent of 20 gallons of gasoline are reviewed. Some of the key features of this system are reviewed in this presentation. L.S.

N78-30324# Miami Univ., Fla.

DATA FOR DESIGN OF A HYDROGEN ENGINE: A PROGRESS REPORT **c37**

Robert R. Adt, Jr. and Michael R. Swain *In* DOE Highway Vehicle Systems Mar. 1978 p 341-350 (For primary document see N78-30293 21-31) Avail: NTIS HC A20/MF A01

A data base is developed for hydrogen engine design and also hydrogen fuel system design. A secondary objective is to try to make sense out of existing hydrogen engine data. Much of the existing data is incoherent. L.S.

N78-30325# Escher Technology Associates, St. Johns, Mich.

ALTERNATIVE FUELS FOR INTERCITY TRUCKING SYSTEMS **c28**

William J. D. Escher *In* DOE Highway Vehicle Systems Mar. 1978 p 350-352 (For primary document see N78-30293 21-31) Avail: NTIS HC A20/MF A01

The objectives are: (1) to compare past and contemporary

alternative fuels work with the needs and problems unique to intercity trucking systems; (2) to document the organizational and equipment characteristics of intercity trucking systems and to identify the problems that would be created by the transition to alternative fuels, and (3) to present a Preliminary Program Plan to assist industry and government planners in developing an effective alternative fuels utilization plan for the intercity trucking sector. L.S.

N78-30326# Department of Energy, Bartlesville, Okla. Energy Research Center.
NON-PETROLEUM FUELS AND COMPATIBLE ENGINES: 1977 BERC UP-DATE REPORT **c28**
R. W. Hurn *In its* Highway Vehicle Systems Mar. 1978 p 352-362 refs (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

Experimental work designed to provide information for best utilization of nonpetroleum transportation fuels is described. Since its inception, this work focused (1) upon fuels and engine systems that could be introduced or adapted in the very short term as a means to alleviate shortfall or potential shortfall in traditional supply and (2) upon fuels that might be produced from oil shale or from coal as supplementary or replacement resources for petroleum. The time frame within which the problem is considered in the context of this program is from the early 80's through the turn of the century. Selection of fuels and fuel components to be used in the study was guided by the following considerations: (1) feasibility of, and energy recovery in, producing fuels from the primary energy resource, (2) availability and extent of the primary resource, and (3) suitability of the fuel for those engine and fuel supply systems that could be expected to be (or become) available within the time frame considered. L.S.

N78-30327# Miami Univ., Fla.
ALCOHOL/GASOLINE BLENDS: LEAN MISFIRE LIMITS **c28**
Robert R. Adt, Jr. *In* DOE Highway Vehicle Systems Mar. 1978 p 362-365 refs (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

Various methods were used for measuring lean misfire limit (LMI) characteristics. The methods and their relative merits are discussed. The four-cylinder Pontiac engine used in the tests is described and all testing was done at steady state conditions. It is shown that there is an extension of the LML when a 20 percent methanol blend is substituted for Indolene (gasoline). This LML extension is attributed to an extension of ignition failure to leaner mixtures with the blend. Of the commonly-used LML detection methods, the counting of motoring cycles, as asscertained from in-cylinder pressure transducer measurement, is more sensitive than the monotoring of HC emissions. The sensitivity of counting misfires audible at the exhaust pipe falls between the sensitivities of the motoring cycle- and HC monitoring-methods. The sensitivity of the standard deviation of the leanest cylinder blowdown-purse pressure as a LML detector is about the same as the sensitivity of the method using motoring cycling frequency-of-occurrence as a LML detector. L.S.

N78-30328# Santa Clara Univ., Calif.
METHANOL UTILIZATION **c28**
Richard Pefley *In* DOE Highway Vehicle Systems Mar. 1978 p 365-376 refs (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

The experimental phase of the program focused on the steady state mapping of performance and exhaust emissions of a dynamometer mounted, 2300cc, Ford Pinto engine. The Indolene and methanol baseline comparison with original equipment indicated that gains in thermal efficiency and reduced exhaust emissions (with the exception of aldehydes) are obtained while operating on methanol at the same engine speed, load, and equivalence ratio phi. All of the observed comparative performance and emissions characteristics were subject to the inherent cylinder-to-cylinder variations in phi of this particular 4-cylinder engine. Based on the observed maldistribution for both Indolene and methanol, it appears that additional relative gains for methanol ranging from 2 to 5 percent in thermal efficiency (and power) are possible if the maldistribution is eliminated in the range 0.8 less than phi less than 1.0. Individual exhaust cylinder measurements were recorded. From these measurements, the maldistribution effects on exhaust emissions of the NOx, UBF and CO were resolved. L.S.

N78-30329# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Labs.
ENGINE LUBRICANTS FOR USE IN METHANOL FUELED HIGHWAY VEHICLES **c37**
E. C. Owens *In* DOE Highway Vehicle Systems Mar. 1978 p 377-385 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

In order to provide an initial screening for problems when methanol fuels are used in conjunction with present commercially available lubricants, a series of engine tests were conducted using the Coordinated Lubricants Research (CLR) single-cylinder engine. The initial test cycle was patterned after the ASTM Sequence II-C cycle normally used to evaluate the rusting and corrosion characteristics of motor oils. After these initial series of wear screening tests were completed, it became apparent that methanol produced additional wear, apparently of a corrosive nature. The CLR was fitted with a piston which allowed diversion and collection of blowby from the piston ring zone for analysis. Analysis of the liquid and gaseous phases of this blowby showed that methanol produced significant concentrations of formaldehyde. In addition, a significant concentration of formic acid was present. L.S.

N78-30330# Michigan Univ., Ann Arbor.
SOLVING ALCOHOL FUEL PROBLEMS BY ENGINE MODIFICATION **c37**
D. J. Patterson *In* DOE Highway Vehicle Systems Mar. 1978 p 385-397 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

The approach used to identify problems and solutions for use of methanol and blends is two pronged. First a careful review of the literature made and pertinent references photocopied and abstracted for the project files. Because published papers often reflect work that is more than one year old and because the understanding of the problems of methanol use is rapidly changing, it was deemed essential to make a number of personal contacts with individuals and laboratories having on-going programs. For this effort, a questionnaire was prepared. This study of the problems and solutions for retrofiting older vehicles is expected to provide guidelines for the design and materials of future vehicles in order to facilitate their operation on methanol or blends should that become desirable. L.S.

N78-30331# Union Oil Co. of California, Los Angeles.
SOLVING ALCOHOL FUEL PROBLEMS BY FUEL MODIFICATION **c28**
James L. Keller *In* DOE Highway Vehicle Systems Mar. 1978 p 397-407 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

There are two basically different methods available for altering these properties so as to alleviate problems: (1) converting methanol itself into other chemical species with more favorable properties and (2) modifying fuel composition by adding or removing other components. Examples of the first are conversion to gasoline hydrocarbons by the Mobil process, conversion to t-alkyl methyl ethers by reaction with olefins, and effective conversion to high alcohols. The latter is taken to include the conversion of CO and H2 partially to higher all alcohols instead of to methanol during methanol synthesis. Possibilities for modification by means of additives and otherwise altering fuel composition are discussed. L.S.

N78-30332# North Atlantic Treaty Organization, Brussels (Belgium). Committee on the Challenges of Modern Society.
PROCEEDINGS OF THE FOURTH INTERNATIONAL SYMPOSIUM ON AUTOMOTIVE PROPULSION SYSTEMS, VOLUME 1
Feb. 1978 529 p refs Symp. held at Washington, D. C., 18-22 Apr. 1977 Sponsored by DOE
(NATO/CCMS-61-Vol-1; Conf-770430-1-Vol-1) Avail: NTIS HC A23/MF A01

The status and plans for research and development in automotive propulsion systems were reviewed. Areas of examination are some of the following: (1) gas turbines; (2)

diesel engines; (3) Stirling and Rankine engines; (4) spark ignition improvements; and (5) alternative fuels. For individual titles, see N78-30333 through N78-30369.

N78-30333*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CATALYTIC COMBUSTION FOR THE AUTOMOTIVE GAS TURBINE ENGINE **c37**
D. N. Anderson *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 47-54 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01 CSCL 21A

Fuel-air premixing-prevaporizing systems and commercial catalysts were studied as part of a demonstration of a low emissions combustor for an automotive gas turbine engine. A fuel preparation system which would supply a fuel-air mixture which was uniform to within + or - 10 percent of the mean fuel-air ratio, with 90 percent fuel vaporization and with no autoignition is described. The catalytic reactor was required to produce emissions which were low enough to meet the most stringent proposed U.S. automotive standards. The overall pressure drop for both systems was to be less than 3 percent, with 1 percent allowed in the fuel-air preparation system and the remainder in the catalytic reactor. B.B.

N78-30334# Chrysler Corp., Detroit, Mich.
THE ERDA/CHRYSLER UPGRADED AUTOMOTIVE GAS TURBINE ENGINE-EMISSION CONTROL SYSTEM **c37**
T. D. Nogle *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 54-63 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

The compact fixed geometry combustor is described. Low emissions are achieved by combustion control in a system which does not sacrifice economy or driveability. Torch ignition of a very lean premixed charge was utilized at steady speeds with rich operation driving compressor stage acceleration transients. Unleaded gasoline was the principle development fuel, but emission control was demonstrated with several potential alternate fuels. B.B.

N78-30335# Volkswagen A.G., Wolfsburg (West Germany).
THE AUTOMOTIVE GAS TURBINE: STATE OF DEVELOPMENT AND PROSPECTS **c37**
P. Walzer *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 63-76 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

At Volkswagen a 55 kW and a 100 kW automotive gas turbine was tested. Continuing efforts on the development of low emission combustion concepts were examined as well as turbine components made from high temperature ceramics. It was predicted that advantages in the fuel economy for heavier cars will be attained, that the Muskie standards can be achieved, and that a wide variety of fuels can be used. B.B.

N78-30336# Nissan Motor Co. Ltd., Tokyo (Japan).
COMBUSTION PERFORMANCE OF INTERMITTENT FUEL INJECTION FOR A GAS TURBINE **c37**
N. Handa *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 77-94 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

The mechanical design, component tests, engine performance, and vehicular application are described for the two-shaft, regenerative gas turbine engine. The engine designed for application to trucks and buses, has a maximum rating of 260 KW (350 HP). The adopted configuration is a single stage centrifugal compressor, two axial turbines (one power turbine), variable second stage nozzle, two ceramic regenerators, and electronic controls. B.B.

N78-30337# United Turbine A.B., Malmo (Sweden).
THREE-SHAFT TURBINE-TRANSMISSION SYSTEMS FOR VEHICULAR APPLICATIONS **c37**
S. O. Kronogard *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 94-115 ref (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

The versatility of the KTT system was highlighted. It was shown how such an engine transmission system can satisfy the installation requirements for light vehicles. Its potential for use in multiple engine installations in larger heavy duty vehicle application was indicated. B.B.

N78-30338# Ford Motor Co., Dearborn, Mich.
CERAMIC GAS TURBINE TECHNOLOGY MATERIALS FOR TURBINE ROTORS **c37**
A. F. McLean, L. R. Swank, and J. C. Uy *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 115-127 refs (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

The hot flow path of an experimental turbine engine was shown schematically. All of the high temperature components in the flow path were designed for ceramics. Various combinations of rotor design material fabrication processes were considered including some of the following: (1) direct hot pressing of an integral silicon nitride rotor; (2) ultrasonic machining of a rotor from a hot pressed silicon nitride billet; and (3) pseudo-isostatic hot pressing of an injection molded silicon nitride preform. B.B.

N78-30339# Booz-Allen Applied Research, Inc., Chicago, Ill.
GAS TURBINE ENGINE APPLICATIONS IN TRANSIT COACHES **c37**
H. Backel *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 127-136 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

An investigation of gas turbine engine application in transit coaches was conducted to determine the viability of the gas turbine engine as a potential power source for transit coaches. An in-depth survey was taken of gas turbine engine manufacturers whose products may be suitable for installation in transit coaches. Their engine products were evaluated to determine their potential merits against those of the conventional diesel engine used in transit coaches. In addition to research and development engines, nearly 100 DDAD gas turbines were field tested in trucks, transit coaches, intercity coaches, marine craft, industrial electrical generator sets, and air compressors. Three DDAD gas turbine engines were installed in the Transbus prototype coaches. B.B.

N78-30340# Detroit Diesel Allison, Indianapolis, Ind.
IMPROVED HEAVY DUTY GAS TURBINE ENGINE **c37**
H. E. Helms *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 136-164 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

An assessment of sensitivity to change in some of the following was summarized: (1) component efficiencies; (2) turbine pressure losses; (3) engine heat rejection; and (4) cooling air requirements. A list of sensitivities compiled shows the change in parameters required to obtain 1 percent improvement in specific fuel consumption. Mechanical analysis was applied to establish which parameters could be improved with development of materials. B.B.

N78-30341# Army Materials and Mechanics Research Center, Watertown, Mass.
REVIEW OF PROOF TESTING ACTIVITIES IN STRUCTURAL CERAMICS **c27**
E. M. Lenoe *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 164-179 refs (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

A technology task on development of proof testing methodology is described. Materials and process development were directed by results of simple mechanical and thermal screening tests as well as various rig tests. A simple cantilevered blade bend failure test gave data on uniformity of ceramic component properties and a further index to measure progress in process technology. Blade flexure tests were applied to both stators and rotors in process development. The proof test load level was established by correlation with observed survival times in the high temperature flow path qualification rig. The stator shrouds were also subjected to proof testing by imposing external pressures of 100 psi in a

special fixture. An elementary globar furnace provided capability to impose radial thermal gradients across the bond line of duodensity ceramic rotors whereas curvic couplings were initially screened by means of a specially designed axial loading device. B.B.

N78-30342# Pratt and Whitney Aircraft, West Palm Beach, Fla. Government Products Div.
NETSHAPE INTEGRAL AND CERAMIC BLADED WROUGHT SUPERALLOY GAS TURBINE ROTORS **c37**
B. H. Walker *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 180-193 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

The superalloy IN-100 was selected for demonstrating: (1) the feasibility of low cost close tolerance forging, using the gatorizing process, and (2) the ability of the wrought superalloy to meet mechanical property requirements for the targeted design limits of the rotor. To fabricate the rotor, a two step forging sequence was selected. The first step produces a nonbladed overthick preform to ensure proper metal distribution for the second step. During the second step the preform is forged to a finish dimension disk and the blades extruded onto the rim of the disk to form the integral bladed rotor. To optimize the forging parameters, various temperatures and strain rates were evaluated to effect proper die fill and resultant response to heat treatment. The optimum forging parameters were found to be a constant strain rate of 0.1 in./in./min (0.25 cm/cm/min) with the preform forged at 1900 F (1038 C) and the final rotor forged at 2000 F (1093 C). B.B.

N78-30343# Mechanical Technology, Inc., Latham, N. Y.
COMPLAINT FOIL AIR BEARINGS FOR HIGH PERFORMANCE AUTOMOTIVE GAS TURBINE **c37**
S. Gray *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 193-220 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

The compliant foil air bearing was used at the turbine position in the gas generator section of the two shaft turbine was illustrated schematically and details of the foil configuration were given. The gas generator rotor operates at 58,500 rpm with an air bearing temperature of about 500 F. B.B.

N78-30344# Ford Motor Co., Dearborn, Mich.
CERAMIC REGENERATOR CORE DESIGN AND RELIABILITY **c37**
C. J. Rahnke *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 220-235 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

Due to unexpected, sporadic failures of the ceramic regenerator in the Ford 707 industrial turbine, a series of controlled durability tests were performed. It was determined that failures were primarily caused by a severe chemical attack on the lithium aluminum silicate (LAS) material used. Tests showed that these LAS ceramics regenerators have a B10 life of 600 hours and a B50 life of 1600 hours. B.B.

N78-30345# Corning Glass Works, N.Y.
ALUMINOUS KEATITE: A NEW CERAMIC REGENERATOR CORE MATERIAL **c27**
D. G. Grossman *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 235-247 refs (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

The history of ceramic rotary regenerator core development for gas turbines was traced and the development of Code 9560 aluminous keatite was described. Also discussed are the development and performance of a new thin wall structure (T14-20) utilizing a sheet only 0.08 mm thick. B.B.

N78-30346# United Stirling A.B., Eskilstuna (Sweden).
THE DEVELOPMENT OF 40-150 kw STIRLING ENGINES IN SWEDEN AND THEIR APPLICATION IN MINING EQUIPMENT, TOTAL ENERGY SYSTEMS AND ROAD VEHICLES **c37**
B. Hallare *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 248-268 refs (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

Development of the Stirling engine components acceptable to the market is described as well as the development of suitable engine configurations. Special market approach for the engine is also discussed. B.B.

N78-30347# D-Cycle Power Systems, Inc., Richmond, Va.
D-CYCLE VAPOR STIRLING ENGINE **c37**
J. G. Davoud *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 268-279 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

A D-cycle condensable vapor Stirling engine is described which has two main advantages: (1) a markedly simplified system for power modulation and (2) a major reduction in the problem of containment of the working fluid. In the D-cycle vapor Stirling engine the preferred working substance is steam which eliminates the need for the complex roll-sock mechanism or interference fit piston rod seals for retaining gas within the engine. Power systems are shown using both steam and ammonia as working fluids, and operating entirely with superheated vapor in a valveless multicylinder double acting engine. B.B.

N78-30348# Ford Motor Co., Dearborn, Mich.
STIRLING ENGINE PROGRAM **c37**
E. Kitzner *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 279-291 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

Reduction of emission levels in automobiles is discussed with relation to the Stirling external combustion engine. A detailed review of testing of the 4-215, 170 HP Stirling powered Torino was given. B.B.

N78-30349# Renner (R. A.), Livermore, Calif.
AUTOMOTIVE RANKINE ENGINE DEVELOPMENT **c37**
R. A. Renner *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 291-297 ref (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

Recent engine development programs are reviewed in reference to the Rankine automotive engine. Various design approaches were examined. Other areas of consideration were: (1) emission control; (2) fuel economy; (3) operating reliability; and (4) thermal efficiency. B.B.

N78-30350# Jay - Carter Enterprises, Inc., Burkburnett, Tex.
DESCRIPTION AND TEST RESULTS OF THIRD GENERATION CARTER STEAM SYSTEM AS INSTALLED IN A VW DASHER **c37**
J. W. Carter, Jr. *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 297-301 refs (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

Bench tests on the Dasher expander were used in conjunction with a computer simulation to determine the fuel economy of the Dasher vehicle. Projected fuel economy in the 2,500 lb. vehicle over the Federal City Driving Cycle is 24.8 mpg. which compares to the best achieved by a 2,500 lb. 1977 vehicle equipped with an automatic transmission. Its idle fuel rate is between .17 and .2 gallons/hour (.75 liters/hour). The complete 85 HP steam system weighs 345 lbs (Figure 203), fits in the Dasher engine compartment, and is capable of vehicle acceleration from 0-60 mph (96.5 km/hour) n 14 seconds. The projected exhaust emissions are below the original 1976 requirements and are a valuable characteristic in the congested city environment. All test results indicate that the engine is a viable candidate as an alternative automobile power plant. B.B.

N78-30351# Thermo Electron Corp., Waltham, Mass.
STATUS REPORT ON AN ORGANIC RANKINE BOTTOMING CYCLE FOR LONG-HAUL DIESEL TRUCKS **c37**
R. J. Raymond *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 301-316 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

A completely integrated compound engine consisting of a diesel engine coupled to a Rankine engine which operates on the exhaust heat of the diesel engine was designed and is undergoing dynamometer testing. Performance predictions indicate an overall fuel saving of approximately 15 percent for a typical long haul truck development. This translates into a national annual fuel savings of over 1.8 billion gallons at consumption levels projected for 1980. The Rankine cycle components are shown and their performance characteristics are indicated. The coupling between the diesel engine and the turbine expander of the Rankine engine is a potential problem area; the final coupling design is indicated. G.Y.

N78-30352# Ricardo & Co., Engineers (1927) Ltd., Shoreham-by-Sea (England).
THE DIESEL IS THE ENGINE FOR HIGH ANNUAL MILEAGE, LIGHT DUTY VEHICLES **c37**
C. C. J. French *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 317-318 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

A brief discussion on diesel engines is given. It is the author's overall proposition that diesel engines for high annual mileage light duty vehicles is the engine proven, widely used, dependable, efficient, and gives a long life with low maintenance costs. G.Y.

N78-30353# Fiat Research Center, Turin, Italy.
GASEOUS EMISSIONS CONTROL FOR HEAVY DUTY DIESEL ENGINES **c37**
C. Lombardi *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 319-329 refs (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

Results are summarized from a study on heavy duty diesel engine emissions. The emission control methods reported are: (1) exhaust gas recirculation; (2) exhaust gas recirculation plus supercharging to the original power level; (3) variable compression ratio; and dual fuel (gasoline and methanol). The work was performed on different direct injection engines, both aspirated and turbocharged, whose characteristics are given. G.Y.

N78-30354# Perkins Engine Co., Peterboro (England).
TURBOCHARGING THE SQUISH LIP LOW POLLUTION DIESEL ENGINE **c37**
C. Goodwin *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 329-336 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

A four-stroke, six cylinder engine of 5.8 liter (354 cu.in.) capacity, turbocharged and charge-cooled, was developed to meet U.S. Federal Heavy Duty Vehicle Emissions Legislation. The engine is based on a new unit for world-wide manufacture, the turbocharged vehicle version being optimized for smoke and fuel consumption. With Squish Lip combustion, injection retard of up to 20 degrees crank angle is possible within acceptable smoke limits, reducing NO by 70 percent over the 13-mode cycle. Lightload advance is required to eliminate misfire and attention to injector nozzle geometry further reduces unburned hydrocarbons. The retarded timing reduces maximum cylinder pressure by 40 percent with benefit to mechanical loading and engine noise. G.Y.

N78-30355# California Univ., Livermore. Lawrence Livermore Lab.
A FLASH RADIOGRAPHIC TECHNIQUE APPLIED TO FUEL INJECTION SPRAYS **c35**
H. C. Vantine *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 336-337 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

A flash radiographic technique, using 50 ns exposure times, was used to study the pattern and density distribution of a fuel injector spray. The experimental apparatus and method are described. An 85 kVp flash X-ray generator is utilized. Radiographic images, recorded on standard X-ray films, are digitized and computer processed. G.Y.

N78-30356# Teledyne Continental Motors, Muskegon, Mich.
AN ADVANCED LOW EMISSION DIESEL ENGINE CONCEPT **c37**
S. H. Hill *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 337-346 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

An automobile diesel engine concept was developed to the preliminary engine design level and demonstrated by simulating vehicle tests with a computer model using steady state engine dynamometer data. The preliminary design is a six cylinder swirl chamber diesel of 209 CID and 130 GHP. This concept engine weighs 495 pounds and employs turbocharging, variable compression ratio, high prechamber main chamber volume ratio, and exhaust gas recirculation. An existing automobile diesel was modified to simulate the concept engine, and steady state engine tests were conducted. Test results were converted to urban cycle results for a 3000 pound GVW vehicle through the use of a computer model. Emission results (grams/mile) are .21 NOx, .24 HC, and 1.24 CO. Fuel consumption (miles/gallon) is 30.3 urban cycle and 36.4 highway cycle. Vehicle cycle results at 3700 pounds GVW meet all emission requirements and exceed the future 27.5 mph requirement by ten percent. Multifuel capability and 175 BMEP power levels were also demonstrated. G.Y.

N78-30357# Cummins Engine Co., Inc., Columbus, Ind.
DIESEL ENGINE AND CONSERVATION **c37**
R. Kamo *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 346-362 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

A study on the emissions and fuel consumption of diesel engines is presented. This paper considers all types of diesel engines for transportation, but with emphasis on the larger heavier duty truck engines. The diesel engine performance and sociability characteristics are presented for continued consideration as vehicular power plants of the future. G.Y.

N78-30358# Volkswagen A.G., Wolfsburg (West Germany).
DESIGN AND LAYOUT OF ENERGY EFFICIENT AND LOW POLLUTING DIESEL ENGINES FOR CAR APPLICATION **c37**
B. Wiedermann *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 362-378 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

Comparison between diesel and spark ignition power plants (engines) are presented. Discussion includes: turbocharging, ceramic materials for use in swirl chambers and noise reduction, to upgrade diesel engines for use in passenger cars. It is concluded that with modern high speed swirl chamber diesel engine design (especially when turbocharged), it is possible to attain power-to-weight and power-to-volume ratios similar to those of present gasoline engines. These engines feature good fuel economy and will meet emission level standards of HC, CO, and NOx, 0.41, 3.4, and 1.5, respectively. The fuel economy ratings which could be attained with these engines in cars of the 2,250 lbs. and 2,500 lbs. weight class are given. G.Y.

N78-30359# Volkswagen A.G., Wolfsburg (West Germany).
DEVELOPMENT STATUS OF THE VOLKSWAGEN STRATIFIED CHARGE ENGINE **c37**
W. Brandstetter *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 378-386 refs (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

Discussion on combustion processes (PCI and PCV) for single-cylinder and 4-cylinder engines is presented. In the PCI combustion process, a fraction of the total fuel is injected into an unscavenged prechamber. In the PCV combustion process, a very fuel rich mixture is drawn into the prechamber through a small intake valve. Investigational studies dealt with reduction in exhaust emissions and fuel consumption. Preference is given to stratified charged engine configurations with a divided instead of an undivided combustion chamber. References are sited for various investigations of stratified charge engines. G.Y.

N78-30360# British Leyland Motor Corp., Ltd., London (England).
BRITISH LEYLAND EXPERIMENTAL STRATIFIED CHARGE ENGINE **c37**
J. H. Weaving *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 387-407 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

Investigations of stratified engines are reported. The object of the testing was to find an engine design that would minimize fuel consumption and reduce exhaust emissions. Emphasis is placed on the effect of throttling on fuel economy and NOx exhaust emissions. G.Y.

N78-30361# Le Moteur Moderne, Boulogne (France).
TWO-CYCLE STRATIFIED CHARGE ENGINE **c37**
J. Prichard *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 407-425 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

Trying to find a low pollutant two-stroke engine configuration at a level at least comparable to that of a conventional four-stroke engine was the objective of this work. Energy consumption was to be reduced as much as possible, although this was not a dominant concern. It is foreseen that the knowledge acquired in the course of research should be applicable to four-stroke automobile engines, considering the great facilities offered by the two-stroke cycle in combustion research. G.Y.

N78-30362# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
MODELING AND EVALUATION OF COMBUSTION PROCESS OF A THREE-VALVE STRATIFIED CHARGE ENGINE **c37**
M. K. G. Babu and S. Yagi (Honda Research and Development Co., Japan) *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 426-432 (For primary document see N78-30332 21-31)
Avail: NTIS HC A03/MF A01

The development of a mathematical model is described for the compression, combustion, and expansion process of a stratified charge engine, consisting of an auxiliary combustion chamber with an inlet valve and main combustion chamber with both the inlet and exhaust valves. After calculating the mixture formation at the end of compression process, a simple combustion model was developed to compute the gas temperature, gas pressure, and the rate of formation of NO and CO at each crank angle, using the basic energy equation and reaction kinetics for both the auxiliary and main chambers. The above calculations were also extended for the expansion process. G.Y.

N78-30363# Fuel Injection Development Corp., Belmar, N. J.
A RETROFIT FUEL VAPOR METERING SYSTEM WITH TORCH IGNITION AND MULTIFUEL CAPACITY **c37**
E. Leshner *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 432-442 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

An air/fuel metering system was developed to combine the advantages of premixed combustion, torch ignition, and servo feedback control of the air-fuel ratio to maintain engine operation at the lean limit. Premixed combustion is achieved by vaporizing all the fuel in a heat exchanger using the waste heat of the exhaust gases. Torch ignition is accomplished by means of Fuel Vapor Injector/Ignitors which replace conventional spark plugs and introduce a small quantity of fuel vapor into the ignition region prior to ignition. Lean limit engine operation is the result of continuous monitoring and optimization of the engine power output per unit of fuel input. Implemented with simple, low cost hardware, the system was retrofitted to four-, six-, and eight-cylinder vehicles. Comparison of the system with conventional metering systems shows marked improvements in both fuel economy and exhaust emissions. G.Y.

N78-30364# Curtiss-Wright Corp., Wood-Ridge, N.J.
AN UPDATE OF THE DIRECT INJECTED STRATIFIED CHARGE ROTARY ENGINE DEVELOPMENTS AT CURTISS-WRIGHT **c37**
C. Jones *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 443-460 refs (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

Development progress of the unthrottled direct injected Stratified Charge Rotary Combustion Engine Program at the Curtiss-Wright Corporation is updated since the 1974 status report. Emphasis during this period was on performance improvements in the automotive road load range. Results are given for a number of variations tested since that date, including engine performance with gasoline and other fuels. The baseline configuration was further improved and new designs which have improved fuel consumption and reduced hydrocarbon emissions. These data are presented showing steady state SFC equal or better than representative automotive diesel engines; comparable untreated emission data are presented with HC emissions reduced to a representative band level of automotive carburetted engines with relatively low CO and NOx. G.Y.

N78-30365# Naval Academy, Annapolis, Md.
NAVAL ACADEMY HEAT BALANCED ENGINE (NAHBE) **c37**
A. A. Pouring *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 461-479 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

Numerous attempts to produce a practical combined cycle, i.e., heat addition at constant volume and constant pressure have failed. A method is described which approaches the problem through the use of a balancing chamber or reservoir, together with an auxiliary air inlet. A balancing chamber is formed in the combustion chamber of the internal combustion engine; this chamber allows a balancing of the heat addition between constant volume and constant pressure. Based on experimental observations in an ASTM CFR standard engine and a transparent engine a model is proposed. An attempt is made to describe the model quantitatively. G.Y.

N78-30366# Porsche (Ferdinand) AG, Stuttgart (West Germany).
OPERATING WITH LEAN MIXTURES: A SOLUTION FOR THE FUTURE? **c37**
R. Hahn *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 480-487 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

Further development of the passenger car engine will definitely be determined by energy and ecology requirements. The reduction of energy consumption and the optimization of the engine for minimal fuel consumption are of most importance. Engine test data are presented showing the following relationships: (1) shape of the combustion chamber - exhaust emission and fuel consumption; (2) compression ratio - exhaust emission, fuel consumption, and lean mixture limit; (3) exhaust emission and fuel consumption with Porsche vehicles; (4) comparison of combustion processes; (5) orifice - auxiliary-chamber-volume; (6) octane requirements of the Porsche 911; (7) exhaust emission of the Porsche 911. G.Y.

N78-30367# Siemens A.G., Erlangen (West Germany). Research Labs.
DEVELOPMENT OF A COMPACT GAS GENERATOR FOR FUEL GASIFICATION ABOARD A MOTOR VEHICLE **c37**
A. Michel *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 488-501 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

The use of gaseous fuels in internal combustion engines represents a suitable means to reduce the specific pollutant emission and the specific fuel consumption when compared with conventional carburetor operations. Gas engines can be operated far into the lean region due to the homogeneous miscibility of fuel gas cylinders. This gives rise to supply problems and makes it difficult to apply this technique to motor vehicles. It is more favorable to generate the low molecular fuel gas from easily storable liquid hydrocarbons within a gas generator aboard the motor vehicle. Requirements for a gas generator are presented. The requirements may be realized through the catalytic partial oxidation of hydrocarbons with air at low air/fuel (A/F) mass

ratios. A suitable catalytic process, operating with an A/F ratio of 0.7 to 1.7 at about 820 C was developed. G.Y.

N78-30368# Stanford Univ., Calif.
CLOSED LOOP CONTROL OF SPARK ADVANCES c37
J. D. Powell *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 P 503-510 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

A closed loop control technique for spark advance control is presented. It is shown to provide the necessary spark advance as a function of speed and load while simultaneously taking into account the changes in optimum spark advance caused by changes in humidity and equivalence ratio. This scheme was experimentally found to give performance within one percent of the performance at MBT (minimum advance for best torque) spark. The mechanization of the controller is described and its transient response is characterized. Closed loop spark advance control was found to be advantageous both at MBT timing and a nominal timing. An adaptive knock control algorithm is presented which would allow the spark controller to be as advanced as warranted under the environmental and engine conditions, and would result in reduced brake specific fuel consumption. G.Y.

N78-30369# Harker Industries, Inc., Annandale, Va.
A NEW LOOK AT EXHAUST GAS RECYCLE AND ITS POTENTIAL FOR IMPROVING FUEL FLEXIBILITY AND ECONOMY OF SPARK IGNITION ENGINES c37
A. Lowi *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 510-515 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

This inquiry proceeds from the general view of engine optimization by charge modification rather than the more narrow objectives of traditional exhaust gas recycle (EGR). Some theoretical and experimental background is reviewed to identify some of the more significant factors characterizing the interaction of the engine and the chemical make-up of the cylinder charge. Some exploratory engine test data were obtained to gain additional appreciation for some of the possibilities for charge modification using certain species found in the engine exhaust. The results were examined for indication of how some of these factors might influence further advancements in the automobile toward reduced rates of both environmental pollution and petroleum consumption. Author

N78-30370# North Atlantic Treaty Organization, Brussels (Belgium).
PROCEEDINGS OF THE FOURTH INTERNATIONAL SYMPOSIUM ON AUTOMOTIVE PROPULSION SYSTEMS, VOLUME 2
Feb. 1978 505 p refs Proc. held at Washington, D. C., 18-22 Apr. 1977
(NATO/CCMS-61-Vol-2; Conf-770430/1-Vol-2) Avail: NTIS HC A22/MF A01

Automobile engine design and transmission system modifications for fuel economy and emission control are described as well as the efficiency of various alternate fuels. Performance standards for electric automobiles and for electric hybrid systems are discussed. For individual titles, see N78-30371 through N78-30419.

N78-30371# Postal Service, Washington, D. C. Transportation Div.
AUTOMOTIVE EMISSIONS c45
T. A. Norman *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 516-524 refs (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

The magnitude of the U.S. Postal fleet and the operational mission of the various sized vehicles used are described. The agency's program for reducing vehicle life cycle costs and decreasing dependence on oil based fuels includes the test and evaluation of light duty diesel engines, stratified charge engines, hydrogen fueled engines, and a gasoline-electric hybrid vehicle. Procedures for testing performance following installation in a 1/4 ton delivery vehicle and during simulated route tests are described. Fuel consumption results indicate that the diesel engine obtained about 122% more miles per gallon during operational use than the gasoline engine under the same conditions. The stratified charge engine, when using diesel fuel, exhibits the same level of fuel efficiency as the diesel engine. The hybrid system consumed the greatest amount of fuel. The hydrogen engine is still under development, and not yet available for testing. A.R.H.

N78-30372# Johnson Matthey Chemicals Ltd., London (England).
DEVELOPMENT OF CATALYSTS FOR EXHAUST EMISSION CONTROL c45
R. A. Searles *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 524-539 refs (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

The use and effectiveness of noble metal catalysts in exhaust emission control is reviewed. More cost effective methods being considered include using low metal loading catalysts with platinum oxidation, changing the volume of the catalyst while maintaining constant precious metal loading, and improving oxidation catalysts such as platinum/paladium and platinum/rhodium oxidation systems. The effect of low, medium, and high metal loading on CO emissions after 300 hours thermal aging is illustrated. The identification of suitable alloys for fabricating multicellular thin-walled metal supports is discussed. A.R.H.

N78-30373# Daimler-Benz, A.G., Stuttgart (West Germany).
EMISSION CONTROL OF V-ENGINES WITH OXYGEN SENSORS c45
H. D. Schuster *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 540-552 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

The various possible arrangements for application of closed loop mixture control with oxygen sensor for fuel-injected V-engines with catalytic emission control are described. The decisive criteria such as fuel injection system, lay-out of exhaust system, characteristics of control, positioning, and operation data of oxygen sensor and catalysts, which define the concept, are reviewed. In addition, the conversion rate of three-way catalysts in quasi-stoichiometric operation is discussed. The influence of nobel metal composition and quantity, as well as aging of catalysts on the size of the air/fuel ratio-window are explained, also the possibility for optimizing the closed loop system CVS test results of such systems are presented. Author

N78-30374# Volkswagen A.G., Wolfsburg (West Germany).
CRITICAL SURVEY OF TEST PROCEDURES FOR AUTOMOTIVE EMISSIONS c45
H. Klingenber *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 553-566 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

Current U.S. and European test procedures for automobile exhaust emissions differ not only in the driving cycles, but also in the sampling and analyzing equipment. The different exhaust emission assembly line test procedures and certification test procedures, including the selective enforcement auditing, are surveyed. A probability analysis carried out shows that there is an important relationship between the certification and assembly line procedures. Proposals for the improvement and standardization of existing procedures are deduced. A.R.H.

N78-30375# Institut Francais du Petrole, Rueil-Malmaison.
DIESEL EXHAUST ODOR MEASUREMENTS c45
P. H. Degobert *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 566-581 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

A sensory analysis system was developed to get simultaneous responses of a selected nose panel of 12 people, sniffing engine exhaust diluted with purified air in known proportions. Because of different individual preferences for certain diesel exhaust odor types, measurements are made by matching the unknown exhaust odors with pyridine standards, chosen as better than standard, and more closely related to certain diesel exhaust odors. Simultaneously, odorous pollutants are analyzed by physio-chemical methods, flame ionization detection for unburned hydrocarbons, MBTH calorimetry for aldehydes, and liquid

chromatography for LCO and LCS fractions following a modified procedure. First results show that the liquid chromatographic data fit neither better nor worse with sensory olfactory results on unburned hydrocarbons and aldehydes. A.R.H.

N78-30376# Technischer Uerberwachungs-Verein Rheinland, e.V., Cologne (West Germany).
EXHAUST GAS EMISSION FACTORS IN THE MOTOR TRAFFIC FIELD: THEIR IMPACT ON AIR POLLUTION CONTROL **c45**
E. Plassmann *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 581-598 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

Cadastral emission surveys, required by the German Federal Air Control Act of 1974, are discussed in relation to the total emissions from passenger cars and their impact on air quality. Road traffic in West Germany is shown to contribute to air pollution by releasing substances other than air consituents, by noise emission, by impairing subsoil water and air during refueling operations, and by contributing scrap and waste materials which must be disposed on through some industrial process. A fleet of 100 passenger cars were tested to establish the 1975 reference year in respect to emission-specific parameters. Topics covered include: (1) the driving mode test for description of road traffic (range and velocity); (2) driving modes for exhaust emissions testing for passenger cars; and (3) emissions and fuel consumption as functions of mean speed and as functions of the registration year of in-use cars. A.R.H.

N78-30377# Billings Energy Research Corp., Provo, Utah.
HYDROGEN ENGINE NOx CONTROL BY WATER INDUCTION **c45**
R. L. Wooley *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 598-608 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

Water induction is an effective means of suppressing flashback and reducing nitrogen oxides in a hydrogen engine. Spraying water into the hydrogen stream prior to mixing with air is more effective than spraying it into the air/hydrogen mixture in the intake manifold. The level of nitrogen oxide production is an exponential function of several parameters: spark advance, equivalence ratio, and ratio of water to hydrogen mass flow rates. Excessive water is not detrimental to engine power and efficiency in the range of interest for automobile engines. A.R.H.

N78-30378# Miami Univ., Fla.
THE EFFECT OF METHANOL ADDITION TO GASOLINE ON TOTAL AND INDIVIDUAL HYDROCARBONS, METHANOL, AND FORMALDEHYDE EMISSIONS FROM A CARBURETTED SPARK IGNITION ENGINE **c45**
R. D. Doepker *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 608-609 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

A four-cylinder, spark ignition carburetted engine was fueled with Indolene (gasoline) and 20 and 30 percent by volume blends of methanol-indolene. Reduced pressure sampling, followed by vapor phase chromatography techniques, were utilized to determine qualitatively and quantitatively the composition of the exhaust emissions, including specific hydrocarbon species, methanol, and formaldehyde. The light C sub 1 through C sub 5 hydrocarbons were also found to decrease with increasing blend level. Separation of these hydrocarbons into saturated and unsaturated hydrocarbons further demonstrate these observed decreases. These C sub 1 through C sub 5 hydrocarbons represent from 65 to 70 percent of the total hydrocarbon emissions on a gram/Hp-hr basis and over 85 percent on a moles/Hp-hr basis. Chemical composition of the C sub 1 through C sub 5 hydrocarbon fraction was independent of blend level, but dependent on equivalence ratio. The C sub 6 through C sub 16 hydrocarbon emissions followed similar trends. A.R.H.

N78-30379# Fiat Research Center, Turin, Italy.
OPTIMIZING THE ENGINE-TRANSMISSION SYSTEM BY MEANS OF AN ELECTRONICALLY CONTROLLED GEARBOX **c37**
L. Marello *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 610-627 refs (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

The extent to which fuel can be saved by driving an automobile over a given route by operating exclusively on the engine utilization mode without altering the engine design characteristics was investigated. Simulation results of a small European car equipped with a conventional transmission, a stepped-ideal transmission, and a stepped automated transmission system during federal driving cycle and highway driving cycles are presented. Hydraulic circuit schematics and control system block diagrams are given for a 5 speed transmission layout having an electronic control unit for selecting and controlling throttle openings, for selecting gear ratio, and for synchronizing transmission during gear ratio changes. The throttle, no longer mechanically linked to the accelerator, is controlled through a much larger loop which includes the computer. Incomplete tests using a car equipped with the experimental gears show the federal possibility of a 17% fuel saving on the federal driving cycle. A.R.H.

N78-30380# Ultra Electronics, Ltd., London (England).
PROGRAMMABLE CONTROLS: A CONTROL ENGINEER'S DREAM **c37**
A. N. Thatcher *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 627-647 ref (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

Practical experience in the automotive gas turbine engine field demonstrates the ease of application and the flexibility of programmable analog controls. Because of the high level programming language and the consequent nonreliance on specialist programmers, the programmable analog controller (PAC) provides the facility for minimizing system development time. The unit, being production hardware, eliminates the cost of electronic circuit development. Applications of the PAC include: Stirling cycle engine control system development, control of a complex steam valve arrangement for submarines, and projected use as a control element in an auto-pilot system to enable accurate positional control of oil rig support vessels in bad weather situations. A.R.H.

N78-30381# General Motors Technical Center, Warren, Mich.
AN ANALYTICAL STUDY OF TRANSMISSION MODIFICATIONS AS RELATED TO VEHICLE PERFORMANCE **c37**
H. E. Chana *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 647-650 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

A method of vehicle performance measurement, developed so that selection of optimum fuel-economy-performance trade-offs can be made for a vehicle having various power train components, was utilized in an analytical study of drive train component features such as overall ratio range, number of ratio steps, locked converters, continuously variable drives. Both manual and automatic type transmissions are considered. Indications are that ratio range is an important consideration in the selection of transmission design parameters, and also conventional transmission concepts can be competitive with the more exotic continuously variable type units. A.R.H.

N78-30382# Little (Arthur D.), Inc., Cambridge, Mass.
A STUDY TO VALIDATE AUTOMOBILE DRIVE TRAIN MODIFICATIONS THAT IMPROVE FUEL ECONOMY **c37**
Philip G. Gott *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 650-651 refs (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

Computerized simulation is used to validate computer predictions of the EPA urban and highway fuel economy improvements that can be achieved through the use of wide-range three- and four-speed automatic transmissions with and without torque converter lock-up. The impact of these transmissions on driveability, engine life, emissions, and performance are also determined. A.R.H.

N78-30383# Orshansky Transmission Corp., San Diego, Calif.
DESIGN FACTORS OF HYDRO-MECHANICAL TRANSMIS-

SIONS FOR PASSENGER CARS **c37**
Peter Huntley *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 651-670 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

A concept demonstration prototype hydromechanical transmission for U.S. passenger cars contains a hydrostatic module consisting of 2 two pump/motor units mounted side by side on countershafts. The gearing, bulkheads, and large case required by the countershafts contribute substantially to the excessive weight of 62 kg in relation to current production automatic transmissions. Although the module is bulkly, it satisfied the original EPA/ERDA requirement that it must package into the transmission tunnel of a U.S. compact car. Continuously variable transmission features and specifications as well as potentials for fuel economy and noise reduction are discussed. A.R.H.

N78-30384# Global Scientific Engineering, Inc., Portland, Oreg.
THE INERTIAL STORAGE TRANSMISSION **c37**
Vincent E. Carman *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 671-672 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

A simple energy storage system that utilizes pressurized oil as an energy storage medium is described. When the internal combustion engine (ICE) and the pump put out more oil than the drive motor requires for vehicle motion, the excess is stored in the accumulator. When a pre-determined pressure is reached, the ICE shuts off. When pressure drops off, the pump is used as a starter motor and ICE restarts. Also, the drive motor is connected as braking pump and vehicle inertia is stored in the accumulator. This results in three means of energy saving: (1) the engine can be shut off instead of idling during deceleration, slow cruise, or when stopped; (2) a small engine (60 HP) and powerful drive motor (150 HP) can combine to give optimum performance in most instances with appreciable savings; and (3) the energy of a moving vehicle is not lost in heat during the braking cycle. A.R.H.

N78-30385# Volkswagen A.G., Wolfsburg (West Germany).
THE EFFECT OF AERODYNAMIC DRAG ON THE FUEL ECONOMY OF PASSENGER CARS **c02**
Hans J. Emmelmann *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 673-680 refs (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

The relationship between fuel economy and aerodynamics for full size and subcompact cars is discussed. Gasoline-powered and diesel-powered synthesized cars were selected for an analysis using a computerized simulation program to predict fuel economy and performance with and without incorporation of aerodynamic improvements. The technique for realizing the desired aerodynamic improvements on cars is shown. By the so-called detail optimization method, a drag coefficient of c sub D = 0.42 within a usual styling concept is achievable. With such optimized gasoline-powered cars maximum improvements in fuel economy referred to average 1977 cars of 7% for full size cars and 4% for subcompact cars are possible. By aerodynamic modification with a minimum assumed drag coefficient of c sub D = 0.32, which implies a styling concept strongly influenced by aerodynamics, improvements in fuel economy of 14% for full size cars and 11% for subcompact cars are achievable. Values for diesel powered cars are included. A.R.H.

N78-30386# Transport and Road Research Lab., Crowthorne (England).
ENERGY FOR ROAD TRANSPORT IN THE UNITED KINGDOM **c28**
J. Porter *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 681-685 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

The use of computer simulation and instrumented cars to identify and evaluate potential energy conservation measures for the short-to-medium term is discussed. For the longer term, when natural crude oil becomes scarce and expensive, vehicles using synthetic gasoline from coal and battery vehicles will be used. These vehicles are compared and the factors needed to give a primary energy advantage of one type of vehicle over the other are examined, as well as other considerations requiring assessment. A.R.H.

N78-30387# Kloeckner-Humboldt-Deutz A.G., Cologne (West Germany).
A SYSTEMS ANALYSIS OF ALTERNATIVE DRIVE UNITS FOR FUTURE HEAVY DUTY TRUCKS **c37**
Wilhelm H. Fausten *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 685-690 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

The shortage of resources and the increasing environmental pollution make it necessary to also consider viewpoints of political economy and ecology among the criteria for selecting automotive power units. A method of systems analysis for the investigation of alternative drive units was developed to provide an unbiased for ascertaining the best drive unit for a special field of application. Future changes in legal requirements and in the market situation are taken into consideration as well as the advances in technology. An investigation based on this method, carried out for a heavy duty truck is discussed. The alternative drive units are a conventional diesel engine predominantly employed in heavy duty trucks, and an unconventional automotive gas turbine. A.R.H.

N78-30388# Harker Industries, Inc., Annandale, Va.
COMBINING ENGINE COOLING WITH HEAT DRIVEN AIR CONDITIONING TO IMPROVE AUTOMOTIVE FUEL ECONOMY **c37**
Alvin Lowi, Jr. *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 691-696 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

A format for evaluating the energy impact of automotive air conditioning and waste heat alternatives is presented. The conceptual design of one such alternative - an organic fluid engine cooling system combined with a novel jet-vapor-compression automotive air conditioning system - is described and evaluated in comparison with the conventional belt-driven vapor compression system added on to the contemporary water-cooled power plant. The salient features of this Rankine bottoming cycle approach and some of its characteristics are also described. The value of shifting from a prime shaft-driven system to a hypothetical light-weight waste heat recovery system is determined for a single model year fleet. A potential reduction in the annual energy cost of automotive air conditioning usage of more than 70 percent is indicated, which is shown to be equivalent to the conservation of about 270 million barrels of crude oil over a ten-year period. A.R.H.

N78-30389# Wayne State Univ., Detroit, Mich.
FLAME SPEEDS, PERFORMANCE, AND EMISSIONS WITH METHANOL-INDOLENE BLENDS **c28**
Naeim I. Henein *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 697-706 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

Methanol, added at different ratios to indolene, has various effects on combustion, performance, and emissions in a CFR-SI engine. Flame speed is measured by fixed ionization probes and by a newly developed travelling ionization probe. The resulting turbulent flame speeds, computed laminar flame speeds, and the equivalent spherical flame speeds are analyzed to detect the turbulence decay over the cycle. The following effects were noted: increased octane number and brake specific fuel consumption, improved thermal efficiency, increased flame speed, increased BSCO and BSHC and decreased BSNOx emissions.
Author

N78-30390# Miami Univ., Fla.
AUTOMOTIVE MATERIALS COMPATIBILITY WITH METHANOL FUEL BLENDS **c26**
L. E. Poteat *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 707-711 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

The effects of methanol on the materials in automobile fuel

systems were investigated using several methanol/gasoline blends including blends with water to simulate moisture pick-up by the methanol. The conditions included ambient and elevated temperatures and with and without agitation. Evaluation was based on weight loss due to uniform corrosion and indications of pitting corrosion, stress corrosion, cracking, and galvanic corrosion. Methanol and methanol/gasoline blends increase the corrosion rates of most metals over the rates found in straight gasoline. Two areas of potential corrosion problems were determined. The most severe problem was the attack of methanol and methanol blends on terne plated steels. Methanol and methanol blends also produced severe pitting in aluminum. Agitation did not appear to have a marked effect on the rate of corrosion, and the difference in temperature from 70 F to 120 F did not make an appreciable difference in corrosion rates. A.R.H.

N78-30391# Volkswagen A.G., Wolfsburg (West Germany).
RECENT PROGRESS IN AUTOMOTIVE ALCOHOL FUEL APPLICATION **c28**
Holger K. Menrad *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 712-727 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

Topics covered include: (1) biomass energy production of ethanol; (2) methanol synthesive; (3) fleet tests of Volkswagen vehicles using 15 volume % methanol mixture; (4) fleet tests using straight methanol or straight ethanol; (5) improved performance of spark ignition engines during bench tests using alcohols as fuel or components; (6) emissions; (7) prototype vehicles using pure methanol fuels; (8) properties of methanol/gasoline blends; and (9) the costs and energy values of methanol and ethanol fuels. A.R.H.

N78-30392# Research Inst. for Road Vehicles, TNO, Delft (Netherlands).
ALTERNATIVE FUELS WITH REGARD TO LPG AND METHANOL **c28**
J. VanDerWeide *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 727-730 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

The increased use of LPG in many Western European countries as an automotive fuel in cars, vans, and taxis results from the long term availability of LPG from the North Sea where it exists in the form of an associated gas. The exhaust emissions produced in seven European cars, each running on four different gasolines (lead-free low octane, lead-free high octane, premium, and regular), LPG and NG were compared. Favorable emission data obtained for LPG and NG are discussed. Strongly reduced exhaust emissions (which meet U.S. standards for 1978) and substantial noise reduction were obtained when LPG was used in city buses during demonstration projects in London, Vienna, and Amsterdam. Cost calculations for large-scale operations are comparable to those for diesel vehicles. Experience with methanol as a fuel or blending component is less extensive. Its use as an alternative fuel in the Netherlands is discussed. A.R.H.

N78-30393# Miami Univ., Coral Gables, Fla.
THE EFFECT OF BLENDING METHANOL WITH GASOLINE ON GEOMETRIC DISTRIBUTION **c28**
R. R. Adt *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 730-732 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

A four cylinder, carbureted engine was fueled with Indolene (gasoline) and a blend of Indolene and 20 percent by volume methanol to determine the effect of the blend on geometric distribution. The engine parameters varied were: engine speed, manifold vacuum, equivalence ratio, and simulated cruising speed. The results show that while both fuels, in general, exhibited similar distribution patterns as a function of the engine parameters, the blend fueled mode of operation yielded a greater difference between the fuel-air equivalence ratios of the richest and leanest cylinders. Author

N78-30394# Energy Research and Development Administration, Bartlesville, Okla. Energy Research Center.
ALTERNATIVE FUELS: THE OUTLOOK AND OPTIONS WITHIN THE NEXT DECADE **c28**
R. W. Hurn *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 732-735 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

A recent interagency governmental study group conclusion that automobile fuel to the year 2000 will be primarily conventional hydrocarbon liquids such as gasoline, diesel fuel, or a combination of gasoline and distillate-type fuels narrows the issue for the primary fuel. However, highly significant questions remain concerning both the possible secondary supplemental fuels and the characteristics of the hydrocarbon type fuels. Such fuels as ammonia and hydrogen which require production, distribution, and engine fuel system technologies can be dismissed for the near-term. The current need is to identify those fuel forms, their fuel characteristics, and the compatible engines that may result from the utilization of solids for conversion to liquid fuels, as well as the adaption of new or upgraded engine technologies to achieve parallel objectives of low emissions and improved fuel economy. A.R.H.

N78-30395# General Motors Research Labs., Warren, Mich.
VEHICLE EVALUATION OF NEAT METHANOL: COMPROMISES AMONG EXHAUST EMISSIONS, FUEL ECONOMY, AND DRIVEABILITY **c28**
N. D. Brinkman *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 736-738 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

Two cars, one carbureted and the other fuel injected, were modified to burn neat methanol. Exhaust emissions, fuel economy, and driveability were measured and compared to those obtained with gasoline in the unmodified (production) cars. Because acceptable driveability and durability were obtained only with the fuel injected car, it was used to investigate the spark timing and equivalence ratio settings which would give an acceptable compromise among exhaust emissions, fuel economy, and driveability. Average equivalence ratios of 0.96 to 0.62 and spark timing from best power to 15 degrees retarded were studied. With spark timing set for best power and the average equivalence ratio for maximum fuel economy (0.83), driveability was acceptable and CO and NOx emissions met the 1977 standards. However, the unburned fuel emissions exceeded the 1977 standards for hydrocarbons, even though the car was equipped with a catalytic converter. At 0.83 average equivalence ratio, NOx emissions were reduced below the statutory standard (0.4) by retarding spark timing; however, driveability and fuel economy deteriorated. Author

N78-30396# General Motors Research Labs., Warren, Mich.
EVALUATION OF ACETYLENE AS A SPARK IGNITION ENGINE FUEL **c28**
D. L. Hilden *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 738 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

Acetylene was evaluated in a single cylinder engine to investigate performance and emission characteristics with special emphasis on lean operation for NOx control. Testing was carried out at constant speed, constant airflow, and MBT spark timing. Equivalence ratio and compression ratio were the primary variables. With acetylene, the engine operated at equivalence ratios as lean as 0.53 and 0.43 for compression ratios of 4 and 6, respectively. However, the operating range was very limited. Knock-induced pre-ignition occurred either with compression ratios above 6 or with mixtures richer than 0.69 equivalence ratio. Both the indicated thermal efficiency and power output were less for acetylene fueling than for gasoline. Acetylene combustion occurred at sufficiently lean equivalence ratios to produce very low NOx and CO emissions. However, when the low NOx levels were achieved, hydrocarbon control was not improved over that with gasoline. A.R.H.

N78-30397# Stevens Inst. of Tech., Hoboken, N. J.
THE PERFORMANCE OF HYDROGEN-FUELED RECIPROCATING ENGINES **c28**
R. B. Cole *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 739-740 (For primary

document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

The thermodynamics and emissions performance of diverse experimental engines fueled with hydrogen are summarized and compared with theoretical (fuel/air cycle) analysis of such engines. Most of the experimental data are from naturally-aspirated spark-ignition engines though several data sets are from fuel-injected engines. The data are found to be highly consistent with fuel/air-cycle analysis, and it is concluded that fuel/air-cycle analysis provides both: (1) an apt (if often neglected) baseline against which to compare both past and future engine performance data and also (2) a suitable basis for describing the potential performance of hydrogen-fueled engines. Author

N78-30398# Daimler-Benz, A.G., Stuttgart (West Germany).
CHARACTERISTICS OF A SINGLE-CYLINDER HYDROGEN-FUELED I.C. ENGINE USING VARIOUS MIXTURE FORMATION METHODS c37
K. W. Drexel and M. Gutmann *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 741-745 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

Research work on hydrogen engines is survey. It is shown how the output of the engine depends on the mixture formation method used. Direct injection of hydrogen into the cylinder results in a gain in b.m.e.p. as compared with mixture formation in the intake pipe. The engine's operational parameters were set to reach minimum fuel consumption and minimum emissions. This involves combined quality/quantity-control and a compression ratio of 7:1 to avoid knocking at stoichiometric air/fuel-ratios. G.Y.

N78-30399# Daimler-Benz, A.G., Stuttgart (West Germany).
RESULTS OF HYDRIDE RESEARCH AND CONSEQUENCES FOR THE DEVELOPMENT OF HYDRIDE VEHICLES c37
H. Buchner *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 746-759 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

From the results attained with the hydride powered vehicles and hydride development it can be demonstrated that hydrogen storage in metal hydrides for virtually nonpullution automative propulsion systems has a number of system specific advantages which, to some extent at least, make up for the relatively adverse weight proportions of the storage tank as compared to liquid hydrocarbons. Provided that suitable hydrides are chosen the hydride tank assumes at least the following four functions at the same time: (1) fuel supply; (2) air conditioning; (3) water condensation; and (4) storage of waste heat from the engine. The hydrogen powered vehicle is thus extremely advantageous for the environment. Its range of operation varies between 200 km and 400 km. Setting up a hydrogen supply system of any desirable size would be technically feasible within a very short time using the steam reforming process of natural gas. G.Y.

N78-30400# Toyota Motor Co., Tokyo (Japan).
A STUDY ON REFORMED FUEL FOR AN AUTOMOTIVE GASOLINE ENGINE c28
K. Onoda *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 759-768 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

A prototype on-board fuel reformer was developed and laboratory tests were conducted to determine the effects of the amount of reformed fuel on cumbustion. The results of these tests are discussed in this paper. On the Japanese test cycle, an extremely low NOx emission level was attained with relatively good fuel economy. However, in a limited combination of engine size and vehicle weight, engine power was sacrificed somewhat because of this lean combustion. A solution to this problem, while maintaining the lower NOx emission level, is to adopt a richer air-fuel ratio and a higher EGR rate. In this approach, the amount of hydrogen must be increased to improve combustion stability. For this purpose, methanol reforming was introduced whereby the additional hydrogen was supplied without any deterioration in energy efficiency. Author

N78-30401# Billings Energy Research Corp., Provo, Utah.
A HYDROGEN-POWERED MASS TRANSIT SYSTEM c85
R. L. Wooley *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 768-773 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

Hydrogen's application to mass transit systems is considered. A 21 passenger bus is converted to hydrogen using a engine which was modified for high compression operation. Backfiring and nitric oxide pollution formation are controlled by a water injection technique. Hydrogen fuel storage for the experimental prototype is accomplished by two metal hydride containers using an iron-titanium alloy. Data are presented regarding equipment conversion and design, energy resource utilization, economics, and safety. G.Y.

N78-30402# Billings Energy Research Corp., Provo, Utah.
REFUELING HYDROGEN TRANSIT FLEETS, PART A: ECONOMICS
R. B. Beyer *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 774-784 refs (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

The economics of several hydrogen manufacturing, distribution, and use strategies are evaluated for a fleet of converted buses for the purpose of setting a guide in selection of feasible methods for refueling. The most attractive alternative is pipeline distribution of hydrogen produced from gasified coal and water for use in FeTi hydride vehicles. A system based on existing technology is estimated to cost midway between the current cost of gasoline (US) and the predicted cost of synthetic gasoline from coal. A hydrogen bus fleet supplied by pipeline will have a lower total cost than systems using other synthetic fuels derived from coal. G.Y.

N78-30403# Billings Energy Research Corp., Provo, Utah.
REFUELING HYDROGEN TRANSIT FLEETS, PART B: DATA c28
R. B. Beyer *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 784-789 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

Data were collected while refueling a prototype hydrogen bus. The refueling operation more severely limits the design of the vehicle tanks than does the discharge condition since the heat transfer must be accomplished in a shorter time. These data indicate that 30 minutes is an attainable refueling period. A significant fraction (40 percent) of the refueling takes place without heat transfer as the hydride increases in temperature. This characteristic can be enhanced and used to advantage such that a fleet based on an hourly quick recharge has a lower operational cost. Sorption characteristics and thermal conductivity for the FeTi hydride used in the vehicle are reported. Author

N78-30404# Mueller Associates, Inc., Baltimore, Md.
ALCOHOLS AND GASEOUS FUELS FROM BIOMASS c28
P. W. McCallum *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 789-795 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

Bioconversion processes for the production of alcohols and gaseous fuels from biomass or organic plant and animal matter are discussed. An anaerobic digestion (fermentation) scheme is presented for the production of methane and ethanol from complex organics and organic starches, respectively. The implications of the utilization of alcohols and gaseous fuels for transportation are discussed. G.Y.

N78-30405# Transportation Systems Center, Cambridge, Mass.
HYBRID HEAT ENGINE PROPULSION OF URBAN BUSES c37
G. Larson *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 795-802 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

The developments to date in hybrid heat engine propulsion of buses are reviewed. Urban bus driving cycles and performance requirements are presented, based upon a survey of available

urban bus driving patterns. Using these cycles and requirements, promising hybrid systems were sized through use of a vehicle propulsion simulation computational program. Both battery and flywheel energy storage subsystems were considered. The results of the hybrid study to date are reported. The heat energy simulated was a diesel. From the near-optimum hybrid propulsion system generated by the trade-off analysis, fuel economy and weight are presented and compared with values of present operational diesel buses negotiating the same driving cycles. A diesel/flywheel series configuration is projected to have at least a 100 percent increase in fuel mileage (mpg) over the baseline diesel bus fuel mileage. Author

N78-30406# Volkswagen A.G., Wolfsburg (West Germany).
ELECTRIC AND HYBRID-VEHICLE POWER-TRAIN DEVELOPMENT **c37**
J. P. Altendorf *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 803-822 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

Prompted by air pollution from emissions from internal combustion engines there is a world-wide effort to find alternative power drive systems. Electric and hybrid drive systems constitute two possible alternatives. The characteristics of the two systems for use in motor vehicles is discussed. Comparisons of the two systems are made. Each power drive system is analysed by characterizing its components. Performance test data are given for an electric delivery truck and a hybrid bus. G.Y.

N78-30407# Wisconsin Univ., Madison.
EXPERIMENTAL EVALUATION OF A FLYWHEEL ENERGY MANAGEMENT AUTOMOBILE **c37**
N. H. Beachley *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 822-829 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

Based on detailed computer simulations and optimization studies, a flywheel-IC engine hybrid automobile was constructed and experimentally evaluated. The power plant consists of a engine with electronic fuel injection, an energy-storage flywheel in an evacuated housing, a continuously variable transmission (CVT) based on the hydrostatic power-split principle, and the necessary controls and instrumentation. Road testing, chassis dynamometer runs, and component tests were conducted to experimentally evaluate the driveability, the control, and the fuel saving potential of the concept and to verify the computer simulation models. G.Y.

N78-30408# ESB, Inc., Yardley, Pa.
FLYWHEEL ELECTRIC MOTOR HYBRID POWER TRAIN FOR ELECTRIC VEHICLES **c37**
G. C. Kugler *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 829-845 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

The performance of an automotive power source can be described using two parameters: energy storage capacity and power output capability. The total amount of usable energy determines the vehicle's range under defined driving profiles, while the maximum power output or the rate of energy utilization limits the maximum dynamic performance capabilities such as rate of acceleration and grade climbing ability. Specific power (watts/lbs.) and specific energy (watt-hours/lb) requirements of a battery used to power an electric vehicle with certain performance envelopes is shown. The hypothetical vehicle weight, 2000 lbs., has a rolling friction of 35 lbs., and an aerodynamic coefficient of 0.60, a frontal area of 20 sq ft., and a battery weight of 500 lbs. It is concluded that the only battery system that will be economically available for the next half decade in high quantity production is lead acid. G.Y.

N78-30409# Fiat Research Center, Orbassano (Italy).
FIAT ELECTRIC CITY CAR PROTOTYPE **c33**
G. Brusaglino *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 846-854 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

Electric vehicles represent an important research activity. One of the themes was the development of a two city car prototype with property designed body. The main purpose was to define a vehicle capable of meeting the multiple requirements of a comfortable and easy driving - handling - parking, and suitable performance for urban operation in level or hilly routes. The general concept is in accordance with a near term solution of the electrical power equipment, both for propulsion and on-board storage systems. The propulsion system consists in a separately excited high specific power d.c. motor fed by transistor double chopper. An Ni-Zn battery was provided for on-board storage equipment. Author

N78-30410# Exxon Enterprises, Inc., New York.
COMPARATIVE EFFICIENCIES OF ALTERNATIVE FUTURE AUTOMOTIVE POWER SYSTEMS **c37**
G. P. Fetterman *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 855-864 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

An analysis of the overall energy efficiency of a small (2 + 2) urban vehicle powered by five different power trains, all with similar acceleration performance and payload capabilities is presented. The drive trains compared are: a hydrogen-fueled-spark-ignition engine, an advanced gasoline-fueled-spark-ignition engine, diesel engine, a diesel/electric hybrid, and a pure electric with an advanced motor/controller and battery. The test weight of each vehicle is varied so that differences in both power system weight and chassis weight propagation are reflected. Each vehicle is mathematically modeled and driven over the EPA urban driving cycle so that its road load energy requirements are generated. The energy usage of each vehicle is then traced through its drive train and fuel processing efficiencies and measured in terms of raw energy in the ground. Estimates are made of the energy used in the production of each vehicle, and the total life cycle energy consumption is calculated. Author

N78-30411# California Univ., Livermore. Lawrence Livermore Lab.
THE FLYWHEEL-BATTERY HYBRID POWER SYSTEMS: A CONCEPT TO IMPROVE ELECTRIC VEHICLE PERFORMANCE **c37**
D. D. Davis *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 864-876 (For primary document see N78-30370 21-31)
(CONF-770430-2) Avail: NTIS HC A22/MF A01

The benefits to be gained through the use of the flywheel in conjunction with improved and advanced batteries predicted for development over the next decade are examined. In addition to the state of the art lead-acid battery, the advanced lead-acid, nickel-zinc, and lithium-iron sulfide systems with 1980-85 development goals are examined as prime power sources for a flywheel-battery hybrid system. In order to illustrate the improvements in range to be realized through the flywheel addition, a four-passenger commute vehicle was chosen as a baseline design. The vehicular model was used to calculate the range of all-battery or hybrid powered baseline vehicles. Range comparisons between the all-battery and hybrid vehicles are made with the vehicles operating at constant velocity and according to a cyclic pattern representative of urban driving. G.Y.

N78-30412# Varta A.G., Frankfurt am Main (West Germany).
PERIPHERAL EQUIPMENT FOR REDUCING MAINTENANCE OF ELECTRIC VEHICLE LEAD-ACID BATTERIES **c33**
K. Salamon *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 876-889 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

Maintenance as well as control of electric vehicle batteries becomes a more and more important problem when the number of vehicles is increasing. Therefore, not only the energy density of a battery, but also the comfort of handling and servicing wins growing interest. This is the reason for considerable effects in developing special devices called periphery components for easier maintenance and supervision of the battery and its performance. A breakdown of the components which reduce the life and increase the maintenance of lead-acid batteries is given. Some new developments on this field are reported.

These include: (1) gas recombination by catalysts; (2) central topping-up systems for easy refilling of the battery; (3) monitoring of acid density charge indicator; and (4) battery cooling for heavy duty batteries. G.Y.

N78-30413# General Research Corp., Santa Barbara, Calif.
PERFORMANCE STANDARDS FOR ELECTRIC VEHICLES **c33**
J. Brennand *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 891-901 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

The rationale leading to recommendations for specific performance standards for near-term and advanced electric vehicles which are to be leased or purchased by the U.S. Energy Research and Development Administration is set forth. The underlying analytical basis is derived. Performance standards include ranges from 50 km (J227a/C, near-term private vehicles) to 150 km (J227a/D, advanced private vehicles). Energy consumption maximum at the input to the charger are 0.25 and 0.2 kW.h/km for the private vehicles (near-term and advanced), and 0.45 and 0.35 kW.h/km for commercial vehicles. Author

N78-30414# AiResearch Mfg. Co., Los Angeles, Calif.
BATTERY-FLYWHEEL POWER SYSTEM FOR AN URBAN AUTOMOBILE **c37**
B. H. Rowlett *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 902-913 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

The work being done under contract to the Energy Research and Development Administration is described. The flywheel supplies the energy for all of the high power requirements, which results in good vehicle acceleration characteristics; the combination of regenerative braking and load leveling of the battery current results in improved range of the vehicle. G.Y.

N78-30415# AiResearch Mfg. Co., Los Angeles, Calif.
A NEW LOOK AT FLYWHEEL PROPULSION FOR URBAN TRANSIT BUSES **c37**
L. J. Lawson *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 913-930 refs (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

A comparative analysis of operational performance, energy effeciency, and lifecycle costs was made of four flywheel propulsion systems in contrast with three baseline vehicles (standard diesel bus, electric trolley coach, and battery bus). The four flywheel propulsion systems are: (1) a pure flywheel system; (2) a flywheel/battery hybrid system; (3) a flywheel/diesel engine hybrid system; and (4) a flywheel-augmented trolley coach. The analysis results show that all four flywheel propulsion configurations have sufficient advantages to remain as candidates for planned design studies. Author

N78-30416# California Univ., Livermore. Lawrence Livermore Lab.
THEORETICAL PERFORMANCE UPGRADING OF THE EVA ELECTRIC VEHICLE BY USE OF A FLYWHEEL/BATTERY HYBRID POWER TRAIN SYSTEM **c37**
R. C. Epps *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 930-942 (For primary document see N78-30370 21-31)
(CONF-770430-3) Avail: NTIS HC A22/MF A01

Performance data for advanced batteries as well as the current state of the art lead-acid battery are shown. The all-electric drive train was theoretically replaced by a hybrid system (flywheel addition) of equal weight and performance and range were evaluated. The vehicle model was used to calculate and compare vehicle performance of the all-electric drive to that of hybrid power system. Test results indicate a rather dramatic improvement in range for the hybrid powered vehicle especially when operating in accordance with the cyclic schedule which represents urban driving conditions. G.Y.

N78-30417# California Univ., Livermore. Lawrence Livermore Lab.
A SYSTEMATIC APPROACH TO THE EVOLUTION OF HIGH PERFORMANCE ELECTRIC VEHICLES **c33**
L. G. OConnell *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 942-948 (For primary document see N78-30370 21-31)
(CONF-770430-1) Avail: NTIS HC A22/MF A01

The performance characteristics of current and future vehicles are examined and compared to projected heat engine vehicle parameters. The shortcomings of electric vehicles in the near-term time frame were discussed. It is predicted that the all-electric vehicle will not gain wide acceptance in the near future because of degraded performance characteristics. Because the near-term low acceptance level of electric vehicles is caused by their overall lower performance level, a hybrid concept is examined which the authors believe can give an enhanced performance level in the short range future. This type of vehicle is proposed as a much needed transition system to provide an evolutionary change from the heat engine system vehicle of today to electric vehicles with acceptable performance in the future. Author

N78-30418# General Electric Co., Schenectady, N. Y.
DESIGN OF A CURRENT TECHNOLOGY ELECTRIC VEHICLE **c33**
Robert H. Guess *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 948-968 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

The trade-offs involved in the design of a general-purpose four-passenger electric vehicle are reviewed. The advantages and disadvantages of three design approaches (series motor with chopper controller, separately excited motor with field control, and flywheel/electric hybrid) are discussed, along with the impact of battery characteristics on the performance of these three systems. The approaches taken in various aspects of vehicle design, including packaging, aerodynamics, and safety, to optimize overall performance and utility are also discussed. G.Y.

N78-30419# Little (Arthur D.), Inc., Cambridge, Mass.
PERFORMANCE CAPABILITY OF NEAR-TERM ELECTRIC AND HYBRID VEHICLES **c37**
B. B. Underhill *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 969-976 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

Graphs comparing the economy and performance of the electric vehicle (EV), internal combustion engine (ICE) vehicle, and hybrid vehicle in terms of energy efficiency and economy, fuel costs, percent of total U.S. energy by use, acceleration characteristics, and range limits are included in this paper to buttress the contentions of the author. G.Y.

N78-30420# California Univ., Livermore. Lawrence Livermore Lab.
ADVANCES IN CLEANING METAL AND GLASS SURFACES TO MICRON LEVEL CLEANLINESS
I. F. Stowers 13 Sep. 1977 23 p Presented at the 24th Natl. Vacuum Symp. of the Am. Vacuum Soc., Boston, 8 Nov. 1977
(Contract W-7405-eng-48)
(UCRL-79702; Conf-771110-2) Avail: NTIS HC A02/MF A01

A high pressure 6.9 MPa solvent spraying technique was developed to remove small (greater than 5 microns) contaminant particles from large (100 sq m) surface areas. Chemically polished and etched stainless steel components are solvent sprayed to achieve cleanliness levels of less than 10 particle/sq cm greater than 5 microns diameter. The high pressure and high liquid velocity cleaning technique is able to remove 99.9 percent of the 5 microns diameter particles in 5 to 10 seconds. Special Class 100 clean room procedures and equipment were developed to verify the cleanliness of the cleaned components and to ensure their remaining clean during installation and operation. The basic technique should find wide application in any field requiring precision cleaned surfaces. ERA

N78-30421# Department of Energy, Washington, D. C.
CONTROLLING THE HAZARDS FROM LNG SPILLS ON THE

GROUND; LNG FIREFIGHTING METHODS AND THEIR EFFECTS; APPLICATION TO GAZ DE FRANCE TERMINALS

Francois Bellus, Henri Cochard, Robert Vincent, and Jean Mauger [1978] 24 p refs Transl. into ENGLISH of report from Gaz de France terminals

(DoE-TR-18) Avail: NTIS HC A02/MF A01

Gaz de France has developed a mathematical model to calculate vapor dispersion from accidental LNG spills on land. This model was applied to make clear the influence of certain parameters in reducing the extension of the plumes. Based on the results of calculations -provided that basic safety features were included in the design and building of the LNG facilities - various types of impounding areas can be considered which are able to minimize the methane cloud travel in case of an accidental LNG spill. An example is given in the paper. A method to calculate the water spray rates for the protection of LNG tank walls from the energy radiated by an adjacent fire is described and a numerical example is given. Results are also given for tests carried out on high expansion foams which were found suitable for controlling LNG fires very rapidly. The details of design and construction of the new 80,000 cum LNG tank are given. ERA

N78-30422# California Univ., Livermore. Lawrence Livermore Lab.

POLISHING AND POLISHING MATERIALS

P. C. Baker 10 Nov. 1977 4 p refs Presented at Optical Soc. of Am. Workshop on Optical Fabrication and Testing, San Mateo, Calif., 10 Nov. 1977

(Contract W-7405-eng-48)

(UCRL-80325; Conf-771138-1) Avail: NTIS HC A02/MF A01

The current approach to optical surface finishing indicates a general dependence on trial and error methods. Some of the detailed research that is being done and which advances the need for a more scientific approach by the opticians are discussed. ERA

N78-30423# Transportation Research Board, Washington, D. C.

CATHODIC PROTECTION FOR REINFORCED CONCRETE BRIDGE DECKS: LABORATORY PHASE Final Report

John B. Vrable (USS Engineers and Consultants, Inc.) Dec. 1977 144 p Sponsored in part by Federal Highway Admin. and Am. Assoc. of State Highway and Transportation Officials, Wash., D. C.

(PB-279427/9; TRB-NCHRP/REP-180; ISBN-0-309-02754-3) Avail: NTIS HC A07/MF A01 CSCL 13M

A laboratory and prototype model study of the application of cathodic protection to control corrosion of concrete bridge deck reinforcement is described. Both impressed-current and sacrificial anode systems were examined. Laboratory studies of the electrochemical behavior of steel in a simulated concrete environment demonstrated that corrosion can be controlled by the application of cathodic current, and indicated desired criteria. A mathematical model was developed to predict rebar potentials for various applied voltages. A work plan for a field evaluation of cathodic protection systems was developed. GRA

N78-30424# National Technical Information Service, Springfield, Va.

FOUNDATIONS IN MARINE ENVIRONMENTS. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1964 - Apr. 1978

Guy E. Habercom, Jr. Jun. 1978 120 p Supersedes NTIS/PS-77/0483; NTIS/PS-76/0418; NTIS/PS-75/255 (NTIS/PS-78/0528/6; NTIS/PS-77/0483; NTIS/PS-76/0418; NTIS/PS-75/255) Avail: NTIS HC $28.00/MF $28.00 CSCL 13J

Citations concerning advances in foundation engineering in marine environments are presented. Studies investigate ocean bottom properties, pile structures, soil mechanics, and seafloor response as related to foundations. This bibliography contains 114 abstracts. GRA

N78-30425# National Technical Information Service, Springfield, Va.

COLD WEATHER CONSTRUCTION. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1964 - Apr. 1978

Guy E. Habercom, Jr. Jun. 1978 278 p Supersedes NTIS/PS-77/0497, NTIS/PS-76/0374 and NTIS/PS-75/394 (NTIS/PS-78/0513/8; NTIS/PS-77/0497; NTIS/PS-76/0374; NTIS/PS-75/394) Avail: NTIS HC $28.00/MF $28.00 CSCL 13M

Construction methods and materials performance in cold weather and in polar environments are presented. The citations exclude permafrost construction. This updated bibliography contains 272 abstracts, 63 of which are new entries. GRA

N78-30426# National Technical Information Service, Springfield, Va.

STRUCTURAL FOUNDATIONS IN SOILS, ICE, SNOW, AND PERMAFROST, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1972 - May 1978

Guy E. Habercom, Jr. Jun. 1978 257 p Supersedes NTIS/PS-77/0535, NTIS/PS-76/0457 and NTIS/PS-75/283 (NTIS/PS-78/0569/0; NTIS/PS-77/0535; NTIS/PS-76/0457; NTIS/PS-75/283) Avail: NTIS HC $28.00/MF $28.00 CSCL 13M

The design and dynamics of foundations, footings, and pile structures are reviewed. The dynamic structural analysis of foundations in cold regions is investigated. This updated bibliography contains 252 abstracts, 60 of which are new entries. GRA

N78-30427# Smithers Scientific Services, Inc., Akron, Ohio.

VALIDATION OF STANDARD SURFACE REPRODUCIBILITY Final Report

James E. Shearer and Richard D. VanArnam Oct. 1977 238 p

(Contract DOT-HS-5-01224)

(PB-280160/3; DOT-HS-803-074) Avail: NTIS HC A11/MF A01 CSCL 13B

A two-year study of skid surface reproducibility utilizing a two-wheeled skid trailer and the reference surfaces of the Field Test Centers of the Federal Highway Administration was conducted. Both ASTM and production tires in various sizes and constructions were used as well as the testing methods set forth in the UTQG procedure. Statistical methods of data analysis were used to determine reproducibility of surfaces. Specific details of the apparatus and calibration procedures are discussed. GRA

N78-30428# California State Dept. of Transportation, Sacramento. Transportation Lab.

VEHICULAR CRASH TEST OF A CONTINUOUS CONCRETE MEDIAN BARRIER WITHOUT A FOOTING Final Report

D. M. Parks, R. L. Stoughton, J. R. Stoker, and E. F. Nordlin Aug. 1977 45 p refs Sponsored by DOT

(PB-280128/0; FHWA-CA-TL-6883-77-22; Rept-636883) Avail: NTIS HC A03/MF A01 CSCL 13B

A vehicular impact test, 4700 lb (2130 kg) vehicle/61 mph (27 m/s)/26 degrees (0l46 rad), was conducted on a continuous New Jersey concrete median barrier (CMB) without a footing cast on an asphalt concrete surface. The test barrier contained two continuous longitudinal No. 4(12.7 mm) steel reinforcing bars one at 6 inches (152 mm) and the other at 12 inches (305 mm) down from the top of the barrier. There were no contraction or construction joints in the barrier. The barrier was allowed to crack randomly. The barrier suffered no structural damage and did not move laterally or rotate about its longitudinal axis during the impact. After being redirected by the barrier, the vehicle rolled over. Changes made in the CMB designs used in California as the result of this test are described. GRA

N78-30429# California State Dept. of Transportation, Sacramento. Transportation Lab.

COLD-MIX ASPHALT CONCRETE SURFACING Final Report

Thomas Scrimsher and Robert N. Doty Aug. 1977 82 p refs Sponsored by DOT

(PB-279374/3; FHWA/CA/TL-3542-77-23; Rept-653542) Avail: NTIS HC A05/MF A01

A contributor to air pollution has been the manufacturing of hot asphalt concrete mixtures. Therefore, the California Department of Transportation initiated a project to determine, by field trials and evaluation, if cold mix asphalt concrete could be used to

reduce pollution and, at the same time, provide a durable asphalt concrete pavement. In conjunction with this field work, laboratory work on the design of asphalt concrete mixtures containing emulsified asphalt was also accomplished. During the field studies, laboratory studies with various emulsions, aggregate gradations, and methods of compaction were also undertaken in an attempt to provide an improved method of laboratory mix design. GRA

N78-30430# Texas Transportation Inst., College Station.
ECONOMIC BITUMINOUS TREATED BASES Final Report, Sep. 1973 - Sep. 1977
Wayne A. Schoen, Jon A. Epps, Bob M. Gallaway, and Dallas N. Little Sep. 1977 236 p refs Sponsored by Texas State Dept. of Highways and Public Transportation and FHWA
(PB-279488/1; TTI-2-6-74-41-2F; FHWA-TX-78-41-2) Avail: NTIS HC A11/MF A01 CSCL 13C

The use of low quality, lower cost, local aggregates in asphalt treated base courses in Texas was studied. Five marginal aggregates were investigated together with three sands and a sand gravel mixture. Results indicate that several of the marginal aggregates can be utilized as bituminous stabilized base courses provided that strict quality and construction control measures are employed. Additionally, these materials must be used under traffic and environmental conditions which are compatible with the stabilized mixture properties. An economic analysis method shows that mixture design and pavement design considerations cannot be separated. GRA

N78-30431# Texas Transportation Inst., College Station.
MIXTURE DESIGN METHODS FOR EMULSION TREATED BASES AND SURFACES Interim Report, Sep. 1973 - Aug. 1977
Dallas N. Little, Jon A. Epps, and Bob M. Gallaway Aug. 1977 85 p refs Sponsored by Texas State Dept. of Highways and Public Transportation and FHWA
(PB-279533/4; TTI-2-6-74-41-1; FHWA-TX-78-41-1) Avail: NTIS HC A05/MF A01 CSCL 13C

Types of tests and criteria for the mixture design of emulsion treated bases and surfaces have been reviewed. A laboratory testing program was conducted to investigate the effort of curing conditions and compaction on the stability and resilient modulus of emulsion stabilized sands. Based on the laboratory study, several sands have been suggested for use as pavement base courses. An interim test method has been suggested for use by the Texas State Department of Highways and Public Transportation. GRA

N78-30432# Transport and Road Research Lab., Crowthorne (England).
TRIAL OF A WIRE-FIBRE-REINFORCED CONCRETE OVERLAY ON A MOTORWAY
J. W. Galloway and J. M. Gregory 1977 27 p
(PB-280504/2; TRRL-LR-764; ISSN-0305-1293) Avail: NTIS HC A03/MF A01 CSCL 13B

To evaluate the potential of wire-fibre-reinforced concrete for thin overlays on heavily trafficked concrete roads in Great Britain, a fullscale experiment was carried out on a length of reinforced concrete carriageway on a motorway which had suffered some cracking. The overlay was constructed in two thicknesses, 60 mm and 80 mm, and three fiber contents were used, 2.7, 2.2 and 1.3 per cent by weight of 0.5 mm x 38 mm Duoform wires. 16 test sections were laid, some of which were bonded to the original pavement slab. Expansion joints were formed in the wet concrete over the expansion joints in the original pavement; additional contraction joints were also formed in the overlay. After a year of heavy traffic examination of cores showed that the bonding technique was satisfactory and that wire bond across cracks was effective. GRA

N78-30433# Transport and Road Research Lab., Crowthorne (England). Materials Div.
AN ACCEPTANCE TEST FOR BITUMEN FOR ROLLED-ASPHALT WEARING COURSE
E. H. Green 1977 38 p refs
(PB-280514/1; TRRL-LR-777) Avail: NTIS HC A03/MF A01 CSCL 13B

Rolled-asphalt wearing course is generally used wherever flexible construction has been specified for a road carrying heavy traffic. Although most bitumens are capable of providing a nonskid surfacing material, some are known which can give a smooth surface which is slippery when wet. Work carried out to develop a test for selecting suitable bitumens is described. A technique in which cores of different wearing-course materials could be inserted in road surfaces was developed to evaluate the performance of a range of bitumens under traffic. At the same time a number of laboratory tests were carried out on the bitumens and it was found that permittivity (dielectric constant) correlated best with development of texture in rolled asphalt, and that the order of merit was maintained irrespective of the composition of the asphalt and of the traffic carried. It was concluded that petroleum bitumen having a permittivity of 2.650 (25C, 1.59 kHz) or more will provide a satisfactory texture under any conditions. The test is applicable only to 100 per cent petroleum bitumen. A method was devised for measuring permittivity accurately. GRA

N78-30434# Transport and Road Research Lab., Crowthorne (England). Bridge Construction Div.
CALCULATED DECK PLATE TEMPERATURES FOR A STEEL BOX BRIDGE
M. R. Jones 1977 31 p refs
(PB-280866/5; TRRL-LR-760) Avail: NTIS HC A03/MF A01 CSCL 13B

A method based on the one dimensional heat flow equations published in TRRL Report LR 561 was used in the case of a steel box bridge to calculate the deck plate temperatures resulting from various conditions of shade temperature, radiation and wind speed. The temperatures of other members of the box (i.e. other than the deck plate) may be deduced from the empirical method given in LR 561. A knowledge of the geometry of the cross-section of the box enables the effective bridge temperature to be calculated. The method which was previously used for extreme environmental conditions, was shown to give calculated temperatures which are in good agreement with those measured experimentally on days of moderate shade temperature and radiation. Some limitations on the method of calculation arise due to the rapid thermal response of steel to changes in solar radiation intensity and to the effect of bituminous surfacing on a steel deck. GRA

N78-30435# Transport and Road Research Lab., Crowthorne (England). Bridge Construction Div.
TEMPERATURES IN BRIDGES DURING THE HOT SUMMER OF 1976
Mary Emerson 1977 37 p refs
(PB-280867/3; TRRL-LR-783) Avail: NTIS HC A03/MF A01 CSCL 13B

The period 23 June to 8 July 1976 is believed to be one of the hottest experienced in this country within the last 250 years. During this period (23 June to 8 July 1976, not the last 250 years) temperatures were being measured in a solid concrete bridge, a composite bridge, in the surfacing of a concrete box bridge, in elevated concrete slabs and on steel plates. The main text of the report presents the variations in surface temperatures and/or effective temperatures of these structures during those sixteen days, together with some of the maximum temperature differences measured through their different depths of construction. Temperatures measured on various types of surface, both on, and above, the ground are also mentioned. The Appendices contain details of the environmental conditions and compare the measured effective bridge temperatures with those predicted in previous laboratory reports. GRA

N78-30436# Transport and Road Research Lab., Crowthorne (England). Materials Div.
SUB-BASE STABILITY: A SHEAR-BOX TEST COMPARED WITH OTHER PREDICTION METHODS
D. C. Pike, S. M. Acott, and R. M. Leech 1977 27 p refs
(PB-280868/1; TRRL-LR-785) Avail: NTIS HC A03/MF A01 CSCL 13B

A series of pilot-scale trafficking trials were carried out with a loaded lorry and with a wheeled paver on several types of crushed rock and sand and gravel sub-bases complying with the Type 1 requirements of the DTp specification; results were used as a basis for comparing the usefulness of methods of predicting stability of such materials under construction traffic.

As expected, simple tests of grading or angularity and descriptions of petrological groups of aggregates were found to be unreliable parameters of stability. CBR tests also gave results which were unsatisfactory for this purpose. Although it was found that the established Mohr-Coulomb shear-strength theory could not be applied to the materials examined, a modified 300mm shear-box test was found to give a reliable classification of stability on non-platic sub-bases. A simpler method, based on measurements of decelerations of a drop-hammer device also shows promise. GRA

N78-30437# Transport and Road Research Lab., Crowthorne (England). Dept. of the Environment.
TECHNIQUES FOR THE INTERPRETATION OF REMOTE SENSING IMAGERY FOR HIGHWAY ENGINEERING PURPOSES
T. E. Beaumont 1977 43 p refs
(PB-280871/5; TRRL-LR-753) Avail: NTIS HC A03/MF A01 CSCL 13B

Some of the new forms of image data and specialized interpretative techniques now available which can be selectively employed to provide more information than that previously gained from standard photointerpretation procedures are discussed. Some enhancement techniques involve visual image analysis such as color additive/subtractive viewing, stereoscopic and pseudo-stereoscopic photointerpretation. A few procedures are ordinarily accomplished through computer analysis (brightness ratioing, atmospheric correction etc.), but others are effective with either imagery or numberical data. This latter group includes density slicing, contrast stretching, cluster analysis, pattern recognition, frequency analysis and edge enhancement. The economics of a project may often be the final consideration in the implementation of most interpretative techniques. GRA

N78-30438# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
APPLICATIONS OF CLOSED-CYCLE CRYOCOOLERS TO SMALL SUPERCONDUCTING DEVICES
James E. Zimmerman and Thomas M. Flynn Apr. 1978 43 p Proc. of a Conf. held at NBS, Boulder, Colo., 3-4 Oct. 1977 Sponsored in part by ONR, Arlington, Va.
(PB-280175/1; NBS-SP-508; LC-78-606017) Avail: NTIS HC A03/MF A01 CSCL 13A

The proceedings are reported of a meeting of specialists in small superconducting devices and in small cryogenic refrigerators. Industry, Government, and academia were represented at the meeting held at the National Bureau of Standards (NBS) on October 3 and 4, 1977. The purpose of the meeting was to define the refrigerator requirements for small superconducting devices and to determine if small cryogenic refrigerators that are produced in relatively large quantities can be adapted or developed to replace liquid helium as the cooling medium for the superconducting devices. Because the focus was on small superconducting devices, the discussion was primarily limited to refrigerators with capacities from zero up to a watt or two in the temperature range of 2 to 20 K. Author

N78-30439# Sydney Univ. (Australia). Civil Engineering Labs.
COMPOSITE CONNECTIONS TO INTERIOR COLUMNS
P. Ansourian Sep. 1977 35 p
(PB-280288/2; R-311) Avail: NTIS HC A03/MF A01 CSCL 13M

Behavior of composite connections to interior columns of building frames is examined in six composite sub-units each consisting of a stub column and pairs of composite T-beams. The beams were subjected to negative bending moment gradient, symmetrical or asymmetrical about the column which carried an axial force of 20 per cent of the squash load. The slab containing 2 per cent longitudinal reinforcement was connected to the joist with a shear connection designed on the same ultimate strength basis as for composite beams in positive bending. Failure in the columns by crushing of the concrete was observed in one specimen; the ultimate strength and rotation of all other specimens were limited by a buckling failure of the compression side of the beam. In the latter case, the theoretical full plastic moment of the section was exceeded by a minimum of 8 per cent and a maximum of 43 per cent. The usefulness of the observed rotation capacity is assessed with reference to a continuous beam having severe negative hinger rotation requirements. GRA

N78-30440# Material Systems Corp., Escondido, Calif.
A STUDY OF THE FEASIBILITY OF UTILIZING SOLID WASTES FOR BUILDING MATERIALS. PHASE 2: SUMMARY REPORT
B. L. Duft, H. Levine, A. McLeod, and Y. Tsur Jun. 1977 280 p
(Contract EPA-68-03-2056)
(PB-279441/0; EPA-600/2-78-092) Avail: NTIS HC A13/MF A01 CSCL 13B

A study to research and develop building materials containing organic and inorganic wastes and waste-derived products is reported. Structural and aesthetic properties of variously formulated composites are evaluated. Limited economic analyses indicate that several commercially viable products could be derived from wastes. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N78-30441 Illinois Univ. at Urbana-Champaign, Urbana.
THE DETERMINATION OF THE DIRECTION OF ARRIVAL OF AN INTERFERENCE FIELD Ph.D. Thesis
Hang Hanley Lai 1978 207 p
Avail: Univ. Microfilms Order No. 78-11261

The problem of resolving the complex interference field at a receiving site that is caused by multimode propagation at high frequencies into the individual plane wave components and determining the direction of arrival of these components is considered. The method developed is based on Prony's algorithm. Effects of noise level on the solution are discussed and examples are illustrated. A first-order linearized model of a statistical study of a simple two plane-wave problem is presented. Problems and discussions pertinent to this conventional algorithm are also presented. An eigenvalue approach, was also applied to this problem. Comparisons and statistical tests of this method with the conventional method are presented. Dissert. Abstr.

N78-30442 Arizona Univ., Tucson.
SCATTERING OF ELASTIC WAVES BY SURFACE PERTURBATIONS Ph.D. Thesis
Edwin Patterson Pierce, Jr. 1978 169 p
Avail: Univ. Microfilms Order No. 78-11509

Elastic wave scattering at a surface, particularly scattering between volume and surface waves induced by surface irregularities is investigated. Two popular first order methods for predicting scattering, the Rayleigh and Small Perturbation methods, are compared and extended in order to provide practical scattering solutions. The comparison shows that scattering solutions obtained by each of the two methods are equal. A FORTRAN program which implements the solution requires only the transform of the perturbation and two specific material parameters to evaluate scattering amplitude as a function of incidence angle and excitation frequency. Also described is the experimental apparatus which was designed to illuminate a surface perturbation with volume waves through a continuously variable incidence angle. Dissert. Abstr.

N78-30443 Drexel Univ., Philadelphia, Pa.
PROPAGATION IN CLAD NON-UNIFORM WAVEGUIDES Ph.D. Thesis
Joel Frederick Rosenbaum 1978 215 p
Avail: Univ. Microfilms Order No. 7810562

Two non-uniform dielectric waveguides are examined. In the uniaxial anisotropic circular guide it is shown that for a positive anisotropy the fractional power carried by the core increases over the isotropic case and that the anisotropy has an increasing effect as cutoff is approached. At any wavelength the increase

in fractional power varies linearly with the anisotropy, with increasing slope as wavelength approaches cutoff. Positive and negative anisotropy cases are considered. A perturbation technique is used to determine the effect of cladding on propagation in inhomogeneous finite slab and fiber dielectric waveguides. Examples are taken from practical fibers and for retinal receptors. Simple formulae describing the effect of the cladding in a square-law medium on the propagation constants of the linearly polarized HE1,n modes have been applied to determine the variation in group velocities in a multimode fiber. Dissert. Abstr.

N78-30444 Illinois Univ. at Chicago Circle, Chicago.
AN AMPLITUDE MODULATED STEREO SYSTEM Ph.D. Thesis
Yoshio Sakaie 1978 169 p
Avail: Univ. Microfilms Order No. 7811087

The work deals with the analysis of AM stereo systems and develops the necessary and sufficient conditions of the general format of AM stereo signal. A multi-tone signal that is believed to represent a practical signal is analyzed. As a practical demodulator of the Am stereo signal, a phase lock loop network is presented. A multi-path transmission interference measure is developed by using the auto- and cross-correlation functions of the receiver signal. The mechanical interference is discussed and the noise interference in the phase signal is analyzed in detail. Dissert. Abstr.

N78-30445 George Washington Univ., Washington, D. C.
PERFORMANCE OF TDM SYNCHRONIZATION IN A FADING DISPERSIVE CHANNEL Ph.D. Thesis
David Russell Smith 1977 225 p
Avail: Univ. Microfilms Order No. 78-10331

The performance of time division multiplexing (TDM) synchronization techniques in the presence of a fading dispersive channel were studied. Interest is confined to frame synchronization. Bit stuffing synchronization is treated, but only as a subset of frame synchronization. Using a random walk model, statistics (mean and variance) are derived for the time to accept synchronization in the acquisition mode and the time to reject synchronization in the maintenance mode. The phenomena of time and frequency dispersion are described via a correlation function or spectral density. Two receiver types are identified for study, the square law combiner when no channel estimate is availabie and the maximal ratio combiner when perfect knowledge of the channel exists. The effect of time and frequency correlation of synchronization is found by deriving an expression for joint probability of errors over the length of synchronization codes. Dissert. Abstr.

N78-30446 California Univ., Los Angeles.
THREE AND FOUR-DIMENSIONAL GEOMETRIC MOMENT BOUNDING WITH APPLICATIONS TO PROBLEMS IN COMMUNICATIONS THEORY Ph.D. Thesis
Maurice Albert King, Jr. 1978 188 p
Avail: Univ. Microfilms Order No. 78-11359

The solutions to many important problems in communication theory take the form of a moment of a function of a random variable. The first half of the dissertation is an analytic extension of the geometrical moment bounding technique to a useful class of three-dimensional geometries. This class of geometries is shown to produce very tight bounds for reasonable computational effort. However, achieving analytical expressions for the general class of three-dimensional bounds, or any higher dimensional bounds, appears to be very difficult. Therefore, in the second half of the dissertation, algorithm solutions are presented. The two algorithms that are presented will solve for the general classes of three and four-dimensional moment bounds. In addition, a technique is outlined that will allow the four-dimensional bounding algorithms to be progressively extended to solve bounding problems of any higher dimension. The major advantage to be gained from higher dimensional moment bounds is in the tightness of the bounds. As the dimensionality increases uniformly tighter bounds will be achievable. Dissert. Abstr.

N78-30447 British Broadcasting Corp., Kingswood (England). Engineering Div.
NARROW-BAND FM SYSTEM FOR TELEVISION LINKS: TESTS OF PERFORMANCE UNDER CONDITIONS OF MULTIPATH PROPAGATION
N. H. C. Gilchrist Jul. 1978 8 p refs
(BBC-RD-1978/22) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

An experimental narrow-band FM system developed for use with band vs television links was tested by using a mobile transmitter and a stationary receiver in a location which has given severe multipath distortion when used for outside broadcasts in the past. It is concluded that the performance of the narrow-band system in respect of multipath susceptibility is at least as good as that of the conventional wide-band system. G.G.

N78-30448 British Broadcasting Corp., Kingswood (England). Engineering Div.
NARROW-BAND FM SYSTEM FOR TELEVISION LINKS: INTERFERENCE BETWEEN FM AND AM TELEVISION SIGNALS
N. H. C. Gilchrist and A. G. Lyner Jul. 1978 15 p ref
(BBC-RD-1978/21) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The Band V FM television links used for television outside broadcasts have suffered more and more from interference as the network of UHF television broadcasting transmitters has expanded. There is also thought to be an increasing danger that Band V Links will cause interference to broadcast television reception. Experimental work was carried out to determine whether reducing the bandwidth of the links can reduce the problem of mutual interference between the links and the broadcasting services in adjacent channels in Band V. The conclusions drawn are that the adoption of a narrow-band VSB system could reduce adjacent-channel interference. F.O.S.

N78-30449 British Broadcasting Corp., Kingswood (England). Engineering Div.
NARROW-BAND FM SYSTEM FOR TELEVISION LINKS: A FEASIBILITY STUDY
R. Storey Jul. 1978 11 p refs
(BBC-RD-1978/20) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

It is shown that FM television signals can be transmitted successfully in a nominal bandwidth of 8 MHz, instead of the nominal 16 MHz used at present. As a consequence of bandwidth reduction both linearity and signal-to-noise ratio were slightly impaired; nevertheless it is thought that a link of this kind should be advantageous under certain conditions. G.G.

N78-30450 California Univ., Berkeley.
MEASUREMENT OF V.L.F. FIELDS Ph.D. Thesis
Devin Brian Trussell 1977 133 p
Avail: Univ. Microfilms Order No. 7812457

The design and field operating procedures for a novel radio receiver are described which can gather very low frequency information. The equipment used synchronous detectors to measure the phase and amplitude of three orthogonal electric and the three orthogonal magnetic field components. The reference signal for the detectors was tied to the phase of the vertical electric field by means of a phase lock loop. Data from an island site located off the California coast are compared to those from an island site. The use of the vertical electric field for phase reference and for amplitude normalization is shown to significantly reduce flutuations with respect to time in very low frequency field components. In particular the marked changes coincident with sunset and sunrise are nearly eliminated.
Dissert. Abstr.

N78-30451*# New Mexico State Univ., Las Cruces. Physical Science Lab.
PROCEEDINGS OF THE 1978 SYNTHETIC APERTURE RADAR TECHNOLOGY CONFERENCE
1978 318 p refs Conf. held at Las Cruces, N. Mex., 8-10 Mar. 1978 Sponsored by NASA. Johnson Space Center
(NASA-CR-157395) Avail: NTIS HC A14/MF A01 CSCL 17I

Calibration techniques, antenna designs, image processing, and systems engineering problems for the synthetic aperture radar are discussed. For individual titles, see N78-30452 through N78-30473.

N78-30452*# New Mexico State Univ., Las Cruces. Physical Science Lab.

SAR ANTENNA CALIBRATION TECHNIQUES

Keith R. Carver and Allen C. Newell (NBS, Boulder, Colo.) *In its* Proc. of the 1978 Syn. Aperture Radar Technol. Conf. 1978 17 p ref (For primary document see N78-30451 21-32)

Avail: NTIS HC A14/MF A01 CSCL 17I

Calibration of SAR antennas requires a measurement of gain, elevation and azimuth pattern shape, boresight error, cross-polarization levels, and phase vs. angle and frequency. For spaceborne SAR antennas of SEASAT size operating at C-band or higher, some of these measurements can become extremely difficult using conventional far-field antenna test ranges. Near-field scanning techniques offer an alternative approach and for C-band or X-band SARs, give much improved accuracy and precision as compared to that obtainable with a far-field approach. Author

N78-30453*# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.

A SIGNIFICANT POST-LAUNCH CALIBRATION EXPERIMENT FOR THE SEASAT-A SAR

Robert C. Beal *In* New Mexico State Univ. Proc. of the 1978 Syn. Aperture Radar Technol. Conf. 1978 15 p refs (For primary document see N78-30451 21-32)

Avail: NTIS HC A14/MF A01 CSCL 17I

A technique for periodically monitoring the impulse response function of the SEASAT-A synthetic aperture radar is outlined that yields most of the significant contributors to the overall instrument transfer function. The essential measurement involves exciting the total SAR system at L-band with a strong point source scatterer, receiving via the normal S-band analog data link, and finally sampling and processing only a small subset of data in the immediaate vicinity of the strong point source. G.G.

N78-30454*# Texas Univ. at Austin. Aerospace Technology Div.

FEATURE DISCRIMINATION/IDENTIFICATION BASED UPON SAR RETURN VARIATIONS

William A. Rasco, Sr. and Roy Pietsch *In* New Mexico State Univ. Proc. of the 1978 Syn. Aperture Radar Technol. Conf. 1978 18 p refs (For primary document see N78-30451 21-32)

(Contract F33615-77-C-1169)

Avail: NTIS HC A14/MF A01 CSCL 17I

A study of the statistics of The look-to-look variation statistics in the returns recorded in-flight by a digital, realtime SAR system are analyzed. The determination that the variations in the look-to-look returns from different classes do carry information content unique to the classes was illustrated by a model based on four variants derived from four look in-flight SAR data under study. The model was limited to four classes of returns: mowed grass on a athletic field, rough unmowed grass and weeds on a large vacant field, young fruit trees in a large orchard, and metal mobile homes and storage buildings in a large mobile home park. The data population in excess of 1000 returns represented over 250 individual pixels from the four classes. The multivariant discriminant model operated on the set of returns for each pixel and assigned that pixel to one of the four classes, based on the target variants and the probability distribution function of the four variants for each class. G.G.

N78-30455*# Kansas Univ., Lawrence. Remote Sensing Lab.

IMAGE SYNTHESIS FOR SAR SYSTEM, CALIBRATION AND PROCESSOR DESIGN

J. C. Holtzman, J. L. Abbott, V. H. Kaupp, and V. S. Frost *In* New Mexico State Univ. Proc. of the 1978 Syn. Aperture Radar Technol. Conf. 1978 10 p refs (For primary document see N78-30451 21-32)

Avail: NTIS HC A14/MF A01 CSCL 17I

The Point Scattering Method of simulating radar imagery rigorously models all aspects of the imaging radar phenomena. Its computational algorithms operate on a symbolic representation of the terrain test site to calculate such parameters as range, angle of incidence, resolution cell size, etc. Empirical backscatter data and elevation data are utilized to model the terrain. Additionally, the important geometrical/propagation effects such as shadow, foreshortening, layover, and local angle of incidence are rigorously treated. Applications of radar image simulation to a proposed calibrated SAR system are highlighted: soil moisture detection and vegetation discrimination. G.G.

N78-30456*# Texas Univ. at Austin. Radio Sciences Div.

DESCRIPTION OF A COMPUTER SIMULATION OF AN ORBITAL SAR SYSTEM

Gary Lynn Crow *In* New Mexico State Univ. Proc. of the 1978 Syn. Aperture Radar Technol. Conf. 1978 20 p ref (For primary document see N78-30451 21-32)

(Contracts NAS9-14892; NAS9-15217)

Avail: NTIS HC A14/MF A01 CSCL 17I

In order to predict the performance of a synthetic aperture radar for a wide variety of system and environmental parameters a computer simulation of the SAR system was developed. This model is a detailed description of the SAR imaging process on a pulse-by-pulse basis. The simulation is implemented as seven computer programs for a CDC Cyber 171 digital computer. G.G.

N78-30457*# California Inst. of Tech., Pasadena. Dept. of Electrical Engineering.

EFFECT OF PIXEL DIMENSIONS ON SAR PICTURE QUALITY

John R. Pierce and Vijaya N. Korwar *In* New Mexico State Univ. Proc. of the 1978 Syn. Aperture Radar Technol. Conf. 1978 6 p refs (For primary document see N78-30451 21-32)

Avail: NTIS HC A14/MF A01 CSCL 17I

In an SAR mapping system, the product of looks per pixel and number of pixels in the scene is kept constant. Assuming that the returns from all resolution cells obey Rayleigh statistics, the expression for pixel SNR incorporating both speckle and additive white Gaussian noise was derived. It is shown that it is possible to use fine resolution and leave the large-area estimate slightly but not much worse than if a larger pixel size had been initially decided upon. G.G.

N78-30458*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

EFFECT OF AMBIGUITIES ON SAR PICTURE QUALITY

Vijaya N. Korwar (Calif. Inst. of Technol.) and Richard G. Lipes *In* New Mexico State Univ. Proc. of the 1978 Syn. Aperture Radar Technol. Conf. 1978 15 p refs (For primary document see N78-30451 21-32)

Avail: NTIS HC A14/MF A01 CSCL 17I

The degradation of picture quality is studied for a high-resolution, large-swath SAR mapping system subjected to speckle, additive white Gaussian noise, and range and azimuthal ambiguities occurring because of the non-finite antenna pattern produced by a square aperture antenna. The effect of the azimuth antenna pattern was accounted for by calculating the aximuth ambiguity function. Range ambiguities were accounted for by adding appropriate pixels at a range separation corresponding to one pulse repetition period, but attenuated by the antenna pattern. A method of estimating the range defocussing effect which arises from the azimuth matched filter being a function of range is shown. The resulting simulated picture was compared with one degraded by speckle and noise but no ambiguities. It is concluded that azimuth ambiguities don't cause any noticeable degradation but range ambiguities might. G.G.

N78-30459*# Hughes Aircraft Co., Culver City, Calif.

SYNTHETIC APERTURE RADAR OPERATOR TACTICAL TARGET ACQUISITION RESEARCH

Michael L. Hershberger and David W. Craig *In* New Mexico State Univ. Proc. of the 1978 Syn. Aperture Radar Technol. Conf. 1978 10 p refs (For primary document see N78-30451 21-32)

(Contract F33615-76-C-1209)

Avail: NTIS HC A14/MF A01 CSCL 17I

A radar target acquisition research study was conducted to access the effects of two levels of 13 radar sensor, display, and mission parameters on operator tactical target acquisition. A saturated fractional-factorial screening design was employed to examine these parameters. Data analysis computed ETA squared values for main and second-order effects for the variables tested. Ranking of the research parameters in terms of importance to system design revealed four variables (radar coverage, radar resolution/multiple looks, display resolution, and display size) accounted for 50 percent of the target acquisition probability variance. Author

N78-30460*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
DEFINITION STUDY OF THE SHUTTLE IMAGING RADAR-A (SIR-A) ANTENNA ON THE SECOND SPACE SHUTTLE MISSION (OFT-2)
Harold A. Nitschke, John W. Kierein (Ball Bros. Res. Corp., Boulder, Colo.), and Thomas A. Metzler (Ball Bros. Res. Corp., Boulder, Colo.) *In* New Mexico State Univ. Proc. of the 1978 Syn. Aperture Radar Technol. Conf. 1978 9 p refs (For primary document see N78-30451 21-32)
Avail: NTIS HC A14/MF A01 CSCL 17I

A definition is derived for an antenna configuration fixed-mounted high in the payload bay on the hybrid OFT-2 pallet which is compatible with Orbiter interface requirements. Tests showed that the combination of the selected panels and the designed corporate feed meets SIR-A performance requirement of 33 db gain. The effects of Orbiter structure proximity on performance were determined by scale model tests to be negligible. The potential for improved performance during subsequent reflights includes a multiple-beam capability and dual polarization. G.G.

N78-30461*# Ball Bros. Research Corp., Boulder, Colo.
PREDICTION OF ANTENNA ARRAY PERFORMANCE FROM SUBARRAY MEASUREMENTS
Martin A. Huisjen *In* New Mexico State Univ. Proc. of the 1978 Syn. Aperture Radar Technol. Conf. 1978 16 p ref (For primary document see N78-30451 21-32)
Avail: NTIS HC A14/MF A01 CSCL 17I

Computer runs were used to determine the effect of mechanical distortions on array pattern performance. Subarray gain data, along with feed network insertion loss, and insertion phase data were combined with the analysis of Ruze on random errors to predict gain of a full array. G.G.

N78-30462*# New Mexico State Univ., Las Cruces. Physical Science Lab.
MATHEMATICAL MODELING AND SIMULATION OF THE SPACE SHUTTLE IMAGING RADAR ANTENNAS
Ross W. Campbell, Karen E. Melick, and Edgar L. Coffey, III *In its* Proc. of the 1978 Syn. Aperture Radar Technol. Conf. 1978 14 p refs (For primary document see N78-30451 21-32)
Avail: NTIS HC A14/MF A01 CSCL 17I

Simulations of space shuttle synthetic aperture radar antennas under the influence of space environmental conditions were carried out at L, C, and X-band. Mathematical difficulties in modeling large, non-planar array antennas are discussed, and an approximate modeling technique is presented. Results for several antenna error conditions are illustrated in far-field profile patterns, earth surface footprint contours, and summary graphs. Author

N78-30463*# Ball Bros. Research Corp., Boulder, Colo.
LOW LOSS, FLEXIBLE, LIGHTWEIGHT CORPORATE RF FEED SYSTEM FOR SAR ANTENNA APPLICATION
Frank Schiavone *In* New Mexico State Univ. Proc. of the 1978 Syn. Aperture Radar Technol. Conf. 1978 8 p refs (For primary document see N78-30451 21-32)
Avail: NTIS HC A14/MF A01 CSCL 17I

Mechanical and electrical efficiency constraints imposed by the SEASAT-A synthetic aperture radar antenna posed difficult design problems. After consideration of available standard cable and waveguide systems, it was determined that an optimum design could be obtained from a suspended substrate RF feed system. Size and mechanical flexibility constraints forced the design of a flexible, suspended substrate section capable of 180-degree flexure. Original design goal for insertion loss over power division was 1 db; measured results indicated 0.6 db maximum across the band. Multipactor testing of system components indicated system breakdown capability in excess of 4 kW compared to a specification input maximum of 1500 W. Author

N78-30464*# Goodyear Aerospace Corp., Litchfield Park, Ariz.
A DUAL POLARIZED ANTENNA SYSTEM USING A MEANDERLINE POLARIZER
Henry A. Burger *In* New Mexico State Univ. Proc. of the 1978 Syn. Aperture Radar Technol. Conf. 1978 5 p refs (For primary document see N78-30451 21-32)
Avail: NTIS HC A14/MF A01 CSCL 17I

Certain applications of synthetic aperture radars require transmitting on one linear polarization and receiving on two orthogonal linear polarizations for adequate characterization of the surface. To meet the current need at minimum cost, it was desirable to use two identical horizontally polarized shaped beam antennas and to change the polarization of one of them by a polarization conversion plate. The plate was realized as a four-layer meanderline polarizer designed to convert horizontal polarization to vertical. G.G.

N78-30465*# Texas Univ. at Austin. Applied Research Labs.
EFFECTS OF RANGE BIN SHAPE AND DOPPLER FILTER RESPONSE IN A DIGITAL SAR DATA PROCESSOR
Carroll R. Griffin *In* New Mexico State Univ. Proc. of the 1978 Syn. Aperture Radar Technol. Conf. 1978 10 p refs (For primary document see N78-30451 21-32)
Avail: NTIS HC A14/MF A01 CSCL 17I

In calibrating the backscatter coefficient obtained with an imaging synthetic aperture radar (SAR) system to determine absolute values of radar cross-section and reflectivity it is common practice to use a target of known radar cross-section placed within the scene. A corner reflector acts as a point target, but the return from it may not be centered in the resolution cell. It is important, for accurate calibration, to perform straddling corrections based on the range bin and Doppler filter response curves. Author

N78-30466*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ELECTRONIC SAR PROCESSORS FOR SPACE MISSIONS
Chialin Wu *In* New Mexico State Univ. Proc. of the 1978 Syn. Aperture Radar Technol. Conf. 1978 19 p refs (For primary document see N78-30451 21-32)
(Contract NAS7-100)
Avail: NTIS HC A14/MF A01 CSCL 17I

An experimental laboratory processor is being developed as a testbed for design of on-board processors for future space missions. The configuration of the experimental processor is described and technical factors pertaining to the design are discussed. G.G.

N78-30467*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CUSTOM LARGE SCALE INTEGRATED CIRCUITS FOR SPACEBORNE SAR PROCESSORS
V. C. Tyree *In* New Mexico State Univ. Proc. of the 1978 Syn. Aperture Radar Technol. Conf. 1978 19 p refs (For primary document see N78-30451 21-32)
(Contract NAS7-100)
Avail: NTIS HC A14/MF A01 CSCL 17I

The application of modern LSI technology to the development of a time-domain azimuth correlator for SAR processing is discussed. General design requirements for azimuth correlators for missions such as SEASAT-A, Venus orbital imaging radar (VOIR), and shuttle imaging radar (SIR) are summarized. Several azimuth correlator architectures that are suitable for implementation using custom LSI devices are described. Technical factors pertaining to selection of appropriate LSI technologies are discussed, and the maturity of alternative technologies for spacecraft applications are reported in the context of expected space mission launch dates. The preliminary design of a custom LSI time-domain azimuth correlator device (ACD) being developed for use in future SAR processors is detailed. G.G.

N78-30468*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
REAL-TIME SAR IMAGE PROCESSING ONBOARD A VENUS ORBITING SPACECRAFT
Wayne E. Arens *In* New Mexico State Univ. Proc. of the 1978 Syn. Aperture Radar Technol. Conf. 1978 16 p refs (For primary document see N78-30451 21-32)
(Contract NAS7-100)
Avail: NTIS HC A14/MF A01 CSCL 17I

The potential use of real-time synthetic aperture radar (SAR) processing to produce 200 meter resolution imagery onboard a 1983 Venus orbiter imaging radar spacecraft is described. The VOIR SAR processing requirements are defined in terms of a nominal baseline design evolving from a 1977 VOIR mission study. A candidate onboard SAR processor architecture compatible with the VOIR requirements is next detailed. Finally, implementation characteristics, based upon currently available integrated

circuits, are estimated in terms of chip count, power, and weight. G.G.

N78-30469*# Goodyear Aerospace Corp., Litchfield Park, Ariz.
APPLICATIONS AND LIMITATIONS OF VERY LARGE-SCALE INTEGRATION IN SAR AZIMUTH PROCESSING
Dennis G. Kuhler *In* New Mexico State Univ. Proc. of the 1978 Syn. Aperture Radar Technol. Conf. 1978 11 p (For primary document see N78-30451 21-32)
Avail: NTIS HC A14/MF A01 CSCL 17I

The major limitation of a convolution processor designed with CCD memory chips is the inability to operate in real time except for slow aircraft speeds or coarse resolutions. Two methods of summing the products were evaluated with respect to speed, power, and space requirements. A convolution processor was designed, and the number of chips as well as the power and volume requirements were determined using 4, 6, and 8 bit data words. The processor is flexible because range samples may be traded for additional azimuth samples by altering the control signals. The processor is also modular, and additional range or azimuth may be processed by adding more cards. G.G.

N78-30470*# General Electric Co., Philadelphia, Pa.
SYNTHETIC APERTURE RADAR IN GEOSYNCHRONOUS ORBIT
Kiyo Tomiyasu *In* New Mexico State Univ. Proc. of the 1978 Syn. Aperture Radar Technol. Conf. 1978 5 p refs (For primary document see N78-30451 21-32)
(Contract NAS2-9580)
Avail: NTIS HC A14/MF A01 CSCL 17I

Radar images of the earth were taken with a synthetic aperture radar (SAR) from geosynchronous orbital ranges by utilizing satellite motion relative to a geostationary position. A suitable satellite motion was obtained by having an orbit plane inclined relative to the equatorial plane and by having an eccentric orbit. Potential applications of these SAR images are topography, water resource management and soil moisture determination. Preliminary calculations show that the United States can be mapped with 100 m resolution cells in about 4 hours. With the use of microwave signals the mapping can be performed day or night, through clouds and during adverse weather. G.G.

N78-30471*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SYSTEM CONCEPT FOR WIDE SWATH CONSTANT INCIDENT ANGLE COVERAGE
J. P. Claassen (Texas A and M Univ., College Station) and J. Eckerman *In* New Mexico State Univ. Proc. of the 1978 Syn. Aperture Radar Technol. Conf. 1978 19 p refs (For primary document see N78-30451 21-32)
Avail: NTIS HC A14/MF A01 CSCL 17I

Multiple beam approach readily overcomes radar ambiguity constraints associated with orbital systems and therefore permits imagery over swaths much wider than 100 kilometers. Furthermore, the antenna technique permits imagery at nearly constant incident angles. When frequency scanning is employed, the center angle may be programmed. The redundant use of the antenna aperture during reception results in lower transmitted power and in shorter antenna lengths in comparison to conventional designs. Compatibility of the approach with passive imagery is also considered. G.G.

N78-30472*# Pennsylvania Univ., Philadelphia. Valley Forge Research Center.
RANDOM SAMPLING ADAPTIVELY FOCUSING SYNTHETIC APERTURE RADAR
Earl N. Powers and Raymond S. Berkowitz *In* New Mexico State Univ. Proc. of the 1978 Syn. Aperture Radar Technol. Conf. 1978 12 p refs (For primary document see N78-30451 21-32)
Avail: NTIS HC A14/MF A01 CSCL 17I

A high resolution narrow angle of view imaging radar system is considered that employs an airborne synthetic aperture of 600 meters operating at X-band to produce a beamwidth of approximately 0.05 mr. This system differs from a conventional SAR in that only a smaller number of wavefront samples, spaced randomly over the aperture are processed, and adaptive beamforming with open loop scanning is used. As a result, the processing requirements are reduced to within the capability of present day small computer technology, and the tolerance on flight stability is loosened by about 100:1. The system is described and initial analysis and evaluation results are presented. G.G.

N78-30473*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE SEASAT-A SYNTHETIC APERTURE RADAR DESIGN AND IMPLEMENTATION
Rolando Jordan *In* New Mexico State Univ. Proc. of the 1978 Syn. Aperture Radar Technol. Conf. 1978 17 p (For primary document see N78-30451 21-32)
Avail: NTIS HC A14/MF A01 CSCL 17I

The SEASAT-A synthetic aperture imaging radar system is the first imaging radar system intended to be used as a scientific instrument designed for orbital use. The requirement of the radar system is to generate continuous radar imagery with a 100 kilometer swath with 25 meter resolution from an orbital altitude of 800 kilometers. These requirements impose unique system design problems and a description of the implementation is given. The end-to-end system is described, including interactions of the spacecraft, antenna, sensor, telemetry link, recording subsystem, and data processor. Some of the factors leading to the selection of critical system parameters are listed. The expected error sources leading to degradation of image quality are reported as well as estimate given of the expected performance from data obtained during a ground testing of the completed subsystems. G.G.

N78-30474*# Kansas Univ. Center for Research, Inc., Lawrence.
ESTIMATES OF OCEANIC SURFACE WIND SPEED AND DIRECTION USING ORTHOGONAL BEAM SCATTEROMETER MEASUREMENTS AND COMPARISON OF RECENT SEA SCATTERING THEORIES
R. K. Moore, A. K. Fung, G. J. Dome, and I. J. Birrer Jun. 1978 116 p refs
(Contract NAS1-10048)
(NASA-CR-158908; TR-186-17) Avail: NTIS HC A06/MF A01 CSCL 20N

The wind direction properties of radar backscatter from the sea were empirically modelled using a cosine Fourier series through the 4th harmonic in wind direction (referenced to upwind). A comparison with 1975 JONSWAP (Joint North Sea Wave Project) scatterometer data, at incidence angles of 40 and 65, indicates that effects to third and fourth harmonics are negligible. Another important result is that the Fourier coefficients through the second harmonic are related to wind speed by a power law expression. A technique is also proposed to estimate the wind speed and direction over the ocean from two orthogonal scattering measurements. A comparison between two different types of sea scatter theories, one type presented by the work of Wright and the other by that of Chan and Fung, was made with recent scatterometer measurements. It demonstrates that a complete scattering model must include some provisions for the anisotropic characteristics of the sea scatter, and use a sea spectrum which depends upon wind speed. Author

N78-30475*# Rice Univ., Houston, Tex.
IONOSPHERE/MICROWAVE BEAM INTERACTION STUDY
Final Report
Wm. E. Gordon and Lewis M. Duncan Jul. 1978 53 p refs
(Contract NAS9-15212)
(NASA-CR-151821) Avail: NTIS HC A04/MF A01 CSCL 20N

The microwave beam of the Solar Power Satellite (SPS) is predicted to interact with the ionosphere producing thermal runaway up to an altitude of about 100 kilometers at a power density threshold of 12 mW/cm sq (within a factor of two). The operation of the SPS at two frequencies, 2450 and 5800 MHz, is compared. The ionosphere interaction is less at the higher frequency, but the tropospheric problem scattering from heavy rain and hail is worse at the higher frequency. Microwave signals from communication satellites were observed to scintillate, but there is some concern that the uplink pilot signal may be distorted by the SPS heated ionosphere. The microwave scintillationos are only observed in the tropics in the early evenings near the equinoxes. Results indicate that large phase errors in the uplink pilot signal can be reduced. S.E.S.

N78-30476*# Alabama A & M Univ., Huntsville. School of Technology.
PSEUDO NOISE TESTING, SUPPLEMENT 2S
30 Jun. 1978 50 p
(Contract NAS9-14770)
(NASA-CR-151824) Avail: NTIS HC A03/MF A01 CSCL 17B

The report is divided into three parts describing three tasks. These tasks include: (1) a study of the application of pseudo noise testing; (2) a modification of the PN Test Set to include the capability of digital filtering in the data and reference channels; and (3) a study of synthesis procedure for long PCM frame synchronization words. G.Y.

N78-30477*# Ford Aerospace and Communications Corp., Palo Alto, Calif.
JPL LARGE ADVANCED ANTENNA STATION ARRAY STUDY Final Report
15 May 1978 144 p Prepared for JPL
(Contract JPL-954973)
(NASA-CR-157553; WDL-TR-7835) Avail: NTIS HC A07/MF A01 CSCL 17B

In accordance with study requirements, two antennas are described: a 30 meter standard antenna and a 34 meter modified antenna, along with a candidate array configuration for each. Modified antenna trade analyses are summarized, risks analyzed, costs presented, and a final antenna array configuration recommendation made. G.Y.

N78-30478*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN 100-METER X AND S BAND MICROWAVE ANTENNA DESIGN AND PERFORMANCE
W. F. Williams 1 Aug. 1978 130 p refs
(Contract NAS7-100)
(NASA-CR-15755; JPL-Pub-78-65) Avail: NTIS HC A07/MF A01 CSCL 20N

The RF performance is studied for large reflector antenna systems (100 meters) when using the high efficiency dual shaped reflector approach. An altered phase was considered so that the scattered field from a shaped surface could be used in the JPL efficiency program. A new dual band (X-S) microwave feed horn was used in the shaping calculations. A great many shaping calculations were made for various horn sizes and locations and final RF efficiencies are reported. A conclusion is reached that when using the new dual band horn, shaping should probably be performed using the pattern of the lower frequency G.G.

N78-30479# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SUB-MESSAGES IN VISUAL LANGUAGES M.S. Thesis [A SUB-MENSAGEM NA LINGUAGEM VISUAL]
Ivonne Tessin Weis and Benedito Vianna DosSantos May 1978 115 p refs In PORTUGUESE; ENGLISH summary
(INPE-1262-TPT/086) Avail: NTIS HC A06/MF A01

The role of sub-messages which may be included in the intended message is discussed. Visual messages are considered. Such messages are often loaded with stereotypes and prejudices in the form of sub messages, often unintentional. Taking into account the great amount of visual stimuli provided by Mass Communication Media (MCM) and the effects of these stimuli on Informal Education, the influence of Informal Education on Formal Education is analyzed. In order to corroborate theoretical considerations, a descriptive study correlating time of exposition to (MCM) with assimilation of stereotypes is presented. The main purposes of this work, intended to be of use to educators and communicators, is to show how to avoid the use of visual instructional material loaded with undesired sub-messages; and, to suggest the deliberate use of adequate sub-messages as an educational aid. A model of image analysis with the aim of detecting nonexplicit content is presented. Such a model of analysis can be applied in production, or in the choice of available instructional material. F.O.S.

N78-30480*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE EFFECT OF WIND ON THE MICROWAVE EMISSION FROM THE OCEAN'S SURFACE AT 37 GHz
Thomas T. Wilheit Jul. 1978 28 p refs
(NASA-TM-79588) Avail: NTIS HC A03/MF A01 CSCL 20N

The microwave brightness temperature measurements from the Electrically Scanned Microwave Radiometer (frequency = 37 GHz) are compared with oceanic wind measurements from data buoys. It is shown that the brightness temperature can be manipulated to yield a measure of the surface roughening which can be very well accounted for by a simple geometric optics model. The data of 1.4, 8.36 and 19.34 GHz were similarly manipulated and shown to require a surface with less slope variance than predicted by optical measurements. It is also shown that the surface may be treated as isotropic to an accuracy equivalent to the roughening produced by a 2 m/s wind speed increment. G.Y.

N78-30481*# National Academy of Sciences - National Research Council, Washington, D. C. Committee on Satellite Communications.
FEDERAL RESEARCH AND DEVELOPMENT FOR SATELLITE COMMUNICATIONS
1977 38 p refs
(Contract NSR-09-012-106)
(NASA-CR-157392) Avail: NTIS HC A03/MF A01; HC also available from National Research Council, 2101 Constitution Ave., N.W., Washington, D.C. 20418 CSCL 17B

A Committee on Satellite Communication (COSC) was formed under the auspices of the Space Applications Board (SAB) in order to study Federal research and development on satellite communications (SC). Discussion on whether to continue the research and development and the proper role of the Federal Government are addressed. Discussion focussed on six possible options for a Federal role in SC research and development: (1) the current NASA SC program; (2) an expanded NASA SC technology program; (3) a SC technology flight test support program; (4) an experimental SC technology flight program; (5) an experimental public service SC system program; and (6) an operational public service SC system program. Decision criteria and recommendations are presented. G.Y.

N78-30482# National Aviation Facilities Experimental Center, Atlantic City, N. J.
DEVELOPMENT OF VOCABULARY FOR DEMONSTRATION OF SPEECH CONCATENATION SYSTEM Interim Report, Jan. 1976 - Nov. 1977
Ephraim Shochet Mar. 1978 50 p refs
(FAA Proj. 131-401-234)
(AD-A051996; FAA-NA-77-43; FAA-RD-77-164) Avail: NTIS HC A03/MF A01 CSCL 17/2

A full and comprehensive vocabulary of words and phrases is derived by message analysis of a large sample of verbal output from a weather answering service to test and evaluate the capability of disseminating messages by a prototype speech concatenation system. Recently developed digital techniques enhance the achievement and acceptability of word-concatenated speech and thus present a future possibility of producing spoken weather reports, and other valuable communication services. A necessary step in the vocabulary preparation phase is the development of a corpus of utterances that represent the linguistic domain for PATWAS messages. This corpus of utterances is contained in this report. G.G.

N78-30483*# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md. Space Dept.
PREDICTION OF ATTENUATION OF THE 28 GHz COMSTAR BEACON SIGNAL USING RADAR AND MEASURED RAIN DROP SPECTRA
Julius Goldhirsh Feb. 1977 46 p refs
(NASA Order S-50748-A; Contract N00017-72-C-4401)
(NASA-CR-156810; APL/JHU-S1R78U-009) Avail: NTIS HC A03/MF A01 CSCL 20N

Disdrometer measurements and radar reflectivity measurements were injected into a computer program to estimate the path attenuation of the signal. Predicted attenuations when compared with the directly measured ones showed generally good correlation on a case by case basis and very good agreement statistically. The utility of using radar in conjunction with disdrometer measurements for predicting fade events and long term fade distributions associated with earth-satellite telecommunications is demonstrated. S.B.S.

N78-30484# LinCom Corp., Pasadena, Calif.
INVESTIGATION OF MODULATION/CODING TRADE-OFF FOR MILITARY SATELLITE COMMUNICATIONS. VOLUME 1: SUMMARY Final Report, 19 Jul. 1976 - 19 Jul. 1977
W. C. Lindsey, J. K. Omura, K. T. Woo, T. C. Huang, and L. Biederman 19 Jul. 1977 72 p refs 2 Vol.
(Contract DCA100-76-C-0062)
(AD-A054589; TR-7807-1276-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 17/2

This final report presents the analysis, computer program documentation, and results of a modulation/coding tradeoff study of satellite communication systems. Performance measures of bit error rates and data bit throughput are evaluated for coherent MPSK signals through bandlimited nonlinear satellite repeaters with uplink and downlink noise. Author (GRA)

N78-30485# LinCom Corp., Pasadena, Calif.
INVESTIGATION OF MODULATION/CODING TRADE-OFF FOR MILITARY SATELLITE COMMUNICATIONS. VOLUME 2: SYSTEM MODELING AND ANALYSIS Final Report, 19 Jul. 1976 - 19 Jul. 1977
W. C. Lindsey, J. K. Omura, K. T. Woo, T. C. Huang, and L. Biederman 19 Jul. 1977 378 p refs 2 Vol.
(Contract DCA100-76-C-0062)
(AD-A054590; TR-7807-1276-Vol-2) Avail: NTIS HC A17/MF A01 CSCL 17/2

The purpose of this study is to investigate modulation, demodulation, and coding techniques to achieve maximum data throughput over nonlinear, bandlimited satellite repeaters for fixed data bit error rates. These techniques include single and multiple coherent MPSK signals sent through the satellite repeater, memoryless and maximum likelihood Viterbi demodulators, and a coding analysis based on computational cutoff rates. GRA

N78-30486# Westinghouse Defense and Electronic Systems Center, Baltimore, Md. Systems Development Div.
LIGHTWEIGHT LINE PULSER Final Technical Report, 1 May 1976 - 1 Dec. 1977
Herman J. Blinchikoff Apr. 1978 55 p refs
(Contract F30602-76-C-0207)
(AD-A054286; RADC-TR-78-73; Rept-78-0099) Avail: NTIS HC A04/MF A01 CSCL 14/2

This report describes the work performed under contract F30602-76-C-0207 to study, develop, and demonstrate the feasibility of a compact, lightweight, modular, pulse-forming network (PFN). The PFN evolved is composed of identical LC modules and an input module that is optimized for a pulse-plateau ripple that satisfies the goal of + or - 0.5 percent. The ripple remains within this limit as modules are added or removed from the PFN to change the pulsewidth in 2 microsec steps. This low-ripple response is achieved without incorporating mutual inductance into the design, therefore, easing the module tuning and assembly. Mutual inductance has been considered indispensible in PFN's, but it is a roadblock for modular construction. Its elimination as a design parameter is the key to realizing the modular PFN. All electrical design goals are satisfied and the size goal was achieved by a wide margin. The realized volume energy density of 0.1 joules/cu in. was the best achievable with off-the-shelf capacitors. The goal of 0.5 joules/cu in. is not compatible with present state-of-the-art components at these power levels. Included herein are results of the following studies undertaken to satisfy the original contract objectives: Theoretical analysis of distributed and lumped constant lines that can realize the PFN. GRA

N78-30487# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
VULNERABILITY, ELECTROMAGNETIC
12 Sep. 1977 38 p Supersedes MTP-6-2-508
(AD-A054097; TOP-6-2-508; MTP-6-2-508) Avail: NTIS HC A03/MF A01 CSCL 20/3

Provides methods for determining the electromagnetic vulnerability of communications-electronics (C-E) equipment. Describes procedures to determine (1) whether C-E systems or equipments possess inherent deficiencies which can be intentionally exploited by enemy electromagnetic means and (2) whether the contribution of the systems or equipments to the electromagnetic environment can be used to detect their presence and location. Author (GRA)

N78-30488# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
POLARIZATION-DIVERSITY RADAR AND LIDAR TECHNOLOGY IN METEOROLOGICAL RESEARCH: A REVIEW OF THEORY AND MEASUREMENTS
James I. Metcalf, Stephen P. Brookshire, and Thomas P. Morton 31 Jul. 1977 95 p refs
(Contract F19628-77-C-0066)
(AD-A054294; GIT-Scientific-1; AFGL-TR-78-0030) Avail: NTIS HC A05/MF A01 CSCL 20/6

Research in polarization-diversity radar and lidar technology as applied to meteorology is reviewed. Review of theory includes development of models for computing hydrometeor backscatter in main and orthogonal channels and development of techniques for interpreting measured parameters. Measurement programs have generally been undertaken with a particular operational objective, such as the identification of hail in severe storms or the measurement of propagation effects. Such programs have generally involved either backscatter measurements or point-to-point propagation measurements. Recent developments have shown that propagation parameters can also be derived from backscatter measurements. The current status of several applications of this technology is described. These include identification of the thermodynamic phase and shape of hydrometeors, the detection of hail, the direct radar measurement of rainfall rate, and the use of polarization diversity for coding of Doppler radar pulses. Author (GRA)

N78-30489# Raytheon Co., Wayland, Mass. Advanced Development Lab.
R AND D EQUIPMENT INFORMATION REPORT: TIME LAPSE STORAGE SYSTEM Final Report, Apr. - Nov. 1977
Florian P. Eggleton, Anthony J. Jagodnik, Jr., and Richard B. Marshall 14 Dec. 1977 67 p
(Contract F19628-77-C-0155)
(AD-A054295; ER77-4370; AFGL-TR-78-0033) Avail: NTIS HC A04/MF A01 CSCL 17/9

Equipment is described which stores and plays back data obtained by a coherent meteorological radar. The Time Lapse Storage System (TLS) operates in two modes, Acquire and Recall. Acquire facilitates the transfer of up to 400 sets of data from four color CRT displays to an 80 megabyte disc, either at user specified intervals or at the end of each antenna scan. During Recall, sets of data are transferred from the 80 megabyte disc to the displays. The user specifies which sets of data he wishes to view and the length of real time display for each set in order to visually track the progress of storm cells. Author (GRA)

N78-30490# Culler/Harrison, Inc., Goleta, Calif.
SPEECH SIGNAL PROCESSING RESEARCH Final Technical Report, 1 Mar. 1973 - 1 Dec. 1976
Glen J. Culler, Michael McCammon, James F. McGill, Dale E. Taylor, and Jan M. Vanderford Apr. 1978 37 p refs
(Contract DAHC15-73-C-0252; ARPA Order 2359)
(AD-A054095; CHI-FIN-101R) Avail: NTIS HC A03/MF A01 CSCL 17/2

Culler/Harrison, Inc. has developed a powerful, versatile signal processing capability for ARPA and utilized this capability to perform significant and diverse signal processing experiments. The contract called for construction, operation and maintenance of the CHI SIGNAL SYSTEM, a combination of equipment and software providing a unique marriage of computing power and on-line interactive control of that power. The system has proved its flexibility and reliability on a broad range of applications encompassing speech compression, on-line control of laboratory experiments, text editing and controlled thermonuclear reactor simulation. An on-line Interactive Math System was developed and implemented on the CHI SIGNAL SYSTEM under this contract. As a research tool the SIGNAL Interactive Math System offers researchers the ability to develop sophisticated signal processing processes, to try out new approaches and receive numerical and graphical feedback on-line interactively, and all with button push turn-around time. GRA

N78-30491# Defense Documentation Center, Alexandria, Va.
OPTICAL RADAR Report Bibliography, Dec. 1963 - Dec. 1977
Jun. 1978 167 p Supersedes DDC-TAS-71-18-1
(AD-A055000; DDC/Bib-78/05) Avail: NTIS HC A08/MF A01 CSCL 17/9

This bibliography contains unclassified-unlimited citations on optical radar. These citations express the use of optical radar techniques, optical devices and techniques, laser applications, optical detection, tracking and scanning, target recognition and discrimination, target acquisition, optical surveillance and performance evaluation guides. The four computer-generated indexes provided are Corporate Author-Monitoring Agency, Subject, Title and Personal Author. Author (GRA)

N78-30492# SRI International Corp., Menlo Park, Calif.
LIDAR OBSERVATIONS OF SMOKE AND DUST CLOUDS AT 0.7-MICROMETER AND 10.6-MICROMETER WAVELENGTHS Technical Report, Jan. 1977 - Apr. 1978
Edward E. Uthe Apr. 1978 33 p refs
(Contract DAAG29-77-C-001; SRI Proj. 5862)
(AD-A054806; ARO-13833.2-GS; TR-1) Avail: NTIS HC A03/MF A01 CSCL 20/5

An experimental program was conducted for the purpose of deriving basic data required to determine the capabilities of 10.6 micrometer-wavelength lidar systems for observation of dense smoke aerosols and for determining specifications for procuring an optimum lidar system for this application. A 10.6 micrometer-wavelength CO2 mobile lidar system was constructed and interfaced to the data-processing electronics of the 0.7 micrometer-wavelength Mark 9 mobile lidar system. The real-time minicomputer-based data system of the Mark 9 lidar was programmed for intensity-modulated TV pictorial display of backscatter data collected from the two lidar systems on an alternate-firing basis. The two-lidar system participated in scheduled tests involving the generation of dense smoke aerosols. Data collected on smoke aerosols and also on road dust consisting of larger-sized particles show that while the 10.6 micrometer system is slightly more sensitive to road dust, it is very insensitive to smoke, and only very dense smokes can be observed. GRA

N78-30493# Polytechnic Inst. of New York, Brooklyn.
STUDY AND DEVELOPMENT OF SPEECH-SEPARATION TECHNIQUES Final Technical Report
Thomas W. Parsons May 1978 51 p refs
(Contract F30602-77-C-0013)
(AD-A054952; RADC-TR-78-105) Avail: NTIS HC A04/MF A01 CSCL 17/2

One of the most common types of interference in speech communication is that caused by the speech of a competing talker. A technique has been developed for suppressing such interference by examining the Fourier transform of the input and selecting the harmonics of the desired voice. The initial version of this process was applicable only to vocalic speech (i.e., speech consisting only of vowels and vowel-like sounds), but in subsequent research steps have been taken to extend the process to natural (i.e., unrestricted) speech. This report describes the improvements which have been made in this research, first, to ruggedize the process so that it can perform in a natural-speech environment, second, to improve the intelligibility and naturalness of the recovered speech, and third, to enable the process to handle the non-vocalic speech sounds (such as plosives and fricatives) which occur in natural speech. Author (GRA)

N78-30494# Air Force Geophysics Lab., Hanscom AFB, Mass.
EQUATORIAL IRREGULARITY CAMPAIGNS, PART 1. CORRELATED SCINTILLATION AND RADAR BACKSCATTER MEASUREMENTS IN OCTOBER 1976 Interim Report
Santimay Basu and Jules Aarons 23 Nov. 1977 49 p refs
(AD-A054961; AFGL-TR-77-0264-Pt-1; AFGL-ERP-617) Avail: NTIS HC A03/MF A01 CSCL 20/14

An intensive study of nighttime electron density irregularities in the equatorial ionosphere was conducted in October 1976 by making simultaneous radar and scintillation measurements near the magnetic dip equator. The 50 MHz radar observations at Jicamarca, Peru, and scintillation measurements at nearby ground stations of Ancon and Huancayo, Peru, were made by receiving VHF transmissions from the geostationary satellites, LES-9 and Marisat, as well as the VHF transmissions from the orbiting Wideband satellite. The thick irregularity patches detected by the radar could be associated with intense scintillation events, signifying thereby that the patches containing 3 m irregularities also contain kilometer-sized irregularities, giving rise to the radar backscatter and scintillations, respectively. By comparison of the onset times of scintillation on different propagation paths separated in the east-west direction, as well as by performance of spaced receiver scintillation measurements at Ancon, the drift speed of irregularities was determined. The irregularities were observed to drift eastwards at a speed ranging between 90 and 140 m per sec during 1900 and 2400 local time. From a knowledge of the derived value of drift speed and the duration of scintillation events, the irregularity patches were found to have eastward dimensions between 100 and 800 kilometers. On a statistical basis, the irregularity patches detected in the scintillation experiment were noted to be preponderant to those giving rise to thick radar backscatter structures. This indicates the possibility of having equatorial irregularity patches with spectral powers concentrated at large scale sizes only. Author (GRA)

N78-30495# Booz-Allen Applied Research, Inc., Bethesda, Md.
APPLICABILITY OF BROADCAST SATELLITE COMMUNICATIONS TO THE INTEGRATED AUTODIN SYSTEM, CIRCA 1990 Final Report, 27 Oct. 1977 - 10 Mar. 1978
Douglas H. Stuard and Thomas J. Mercer 10 Mar. 1978 82 p refs
(Contract DCA100-77-C-0057)
(AD-A054899; AD-E100053) Avail: NTIS HC A05/MF A01 CSCL 17/2

This report presents the results of an initial assessment of potentially promising approaches for circa 1990 IAS satellite communications. A survey of satellite systems parameters was performed and the cost effectiveness of various satellite configurations was determined. Author (GRA)

N78-30496# Ohio State Univ., Columbus. Dept. of Electrical Engineering.
COMMUNICATION APPLICATIONS OF ADAPTIVE ARRAYS Quarterly Report, 1 Dec. 1977 - 28 Feb. 1978
R. T. Compton, Jr. Apr. 1978 7 p ref
(Contract N00019-78-C-0131)
(AD-A054905; ESL-710929-1) Avail: NTIS HC A02/MF A01 CSCL 17/2

This report describes progress under Naval Air Systems Command Contract N00019-78-C-0131 during the first quarterly period. Research on the use of adaptive arrays in conventional communication systems is summarized. Author (GRA)

N78-30497# Utah Univ., Salt Lake City. Dept. of Computer Science.
NOISE SUPPRESSION METHODS FOR ROBUST SPEECH PROCESSING Semiannual Technical Report, 1 Oct. 1977 - 31 Mar. 1978
Steven F. Boll, Dennis Pulsipher, William Done, Ben Cox, and Jim Ajiya Apr. 1978 111 p refs
(Contract N00143-77-C-0041; ARPA Order 3301)
(AD-A054911; UTEC-CSC-78-073) Avail: NTIS HC A06/MF A01 CSCL 20/1

Robust speech processing in practical operating environments requires effective environmental and processor noise suppression. This report describes the technical findings and accomplishments for the research program funded to develop real time, compressed speech analysis-synthesis algorithms whose performance is invariant under signal contamination. Fulfillment of this requirement is necessary to insure reliable secure compressed speech transmission within realistic military command and control environments. Overall contributions resulting from this research program include the understanding of how environmental noise degrades narrow band, coded speech: development of appropriate real time noise suppression algorithms and development of speech parameter identification methods that consider signal contamination as a fundamental element in the estimation process. This report describes the current research and results in the areas of noise suppression using the SABER algorithm, dual input adaptive noise cancellation using the LMS algorithm, pole-zero parameter

estimation, nonparametric-rank order statistics applications to Robust Speech activity detection, and spectral analysis and synthesis using the constant-Q transform. GRA

N78-30498# Naval Ocean Systems Center, San Diego, Calif.
EMC ANALYSIS FOR AN/USC-34(XN-1) LINK 11 HF RADIO
L. J. Kinkel 1 Mar. 1978 48 p refs
(AD-A055011; NOSC/TR-151) Avail: NTIS HC A03/MF A01 CSCL 17/2

This document provides information on electromagnetic compatibility (EMC) of candidate shipboard radio systems using the AN/USC-34(XN-1) Link 11 hf radio. Typical antenna and HF distribution systems for both large and small ship classes are included as part of the EMC environment. The AN/USC-34 (XN-1) is designed as a lower cost NTDS Link 11 radio, using modified AN/URT-23 transmitter and R-1051/URR receiver. Both measured and analytical results are included as part of the analytical model. Author (GRA)

N78-30499# Battelle Pacific Northwest Labs., Richland, Wash.
ELECTROMAGNETIC COMPATIBILITY, TROPOSPHERIC AND IONOSPHERIC ASPECTS OF SPS MPTS OPERATIONS
Mar. 1978 40 p refs
(Contract EW-78-I-06-1071)
(PNL-2616) Avail: NTIS HC A03/MF A01

The results of a preliminary study of the effects of operation of a Solar Power Satellite (SPS) on the general performance of terrestial and space based electromagnetic systems are given. In addition, the effects of a passing high energy Microwave Power Transmission System(MPTS) through the troposphere and through the ionosphere are also considered. Study topics include: (1) the susceptibility of electronic equipment to SPS emission; (2) the interference potential of SPS emission and harmonics to electromagnetic systems; (3) the impact of tropospheric attenuation and scattering associated with SPS operation on microwave terrestrial, air/ground and satellite/ground telecommunication systems; (4) the production of ionospheric irregularities resulting from microwave heating; and (5) impact of SPS operation on the telecommunication system performance collected in conjuction with a microwave heating experiment. ERA

N78-30500# California Univ., Livermore. Lawrence Livermore Lab.
ON INCREASING THE RADIATION EFFICIENCY OF BEVERAGE - TYPE ANTENNAS
E. K. Miller, R. J. Lytle, D. L. Lager, and E. F. Laine 6 Jul. 1977 22 p refs
(Contract W-7405-eng-48)
(UCRL-52300) Avail: NTIS HC A02/MF A01

It was shown that multiwire Beverage antennas are more efficient radiators than their single wire counterparts. An explanation for this result, based on longitudinal current behavior, is developed and demonstrated. ERA

N78-30501# Ferranti Ltd., Bracknell (England). Digital Systems Div.
DESCRIPTION OF A SIMULATION MODEL OF SYNTHETIC APERTURE RADAR SYSTEMS. VOLUME 1: SUMMARY
R. Sellars Paris ESA Jul. 1977 72 p refs 2 Vol.
(Contract ESTEC-2567/75-HP)
(Rept-2831-Vol-1; ESA-CR(P)-1059-Vol-1) Avail: NTIS HC A04/MF A01

The development of a digital computer simulation model for a satellite-borne Synthetic Aperture Radar (SAR) system is reported. Requirements of earth remote sensing are outlined, showing how a synthetic aperture radar can satisfy these requirements. The development of a simulation program to study SAR processing operations is discussed, based on a broad type of SAR system. The program design philosophy and the most important program segments are dealt with. A few examples are given of results from the program, and the use of the model by an SA systems designer is shown. Recommendations are given for future work. ESA

N78-30502# Ferranti Ltd., Bracknell (England). Digital Systems Div.
DESCRIPTION OF A SIMULATION MODEL OF SYNTHETIC APERTURE RADAR SYSTEMS. VOLUME 2: THEORY AND RESULTS
P. R. Tucker, D. Farquharson, A. J. Dick, and R. Sellars Paris ESA Jul. 1977 147 p 2 Vol.
(Contract ESTEC-2567/75-HP)
(Rept-2831-Vol-2; ESA-CR(P)-1059-Vol-2) Avail: NTIS HC A07/MF A01

The development of a digital computer simulation model for a satellite-borne Synthetic Aperture Radar (SAR) system is reported. The broad type of SAR system that was assumed, is described, as well as a general theory of SAR systems. Methods of simulating the various system components are presented. The data analysis and output facilities provided by the model are outlined, and its use is discussed. A number of secondary studies performed during the model development are described, and a few examples are given of results from the model to indicate the form of the output. Suggestions are made for future work. ESA

N78-30503# Centre National d'Etudes Spatiales, Toulouse (France).
STUDY OF ELLIPTIC FILTERS OPERATING AT 3.960 GHz FOR COMMUNICATION SATELLITE TRANSPONDERS [ETUDE DE FILTRES ELLIPTIQUES A 3.960 GHz DESTINES AUX REPETEURS DE SATELLITES DE TELECOMMUNICATION]
Patrick Deschamps Dec. 1977 62 p refs In FRENCH; ENGLISH summary
(CNES-NT-80) Avail: NTIS HC A04/MF A01

The elliptic function filters described, used for communications satellite transponders with bandpass filter multiplexers, are made from coupled circular waveguide cavities. Orthogonal modes are excited with coupling screws and irises in the cavities. These filters have advantages over classical ones such as the Tchebycheff or Butterworth filters; they are lighter and both their amplitude ripple and their time group-delay in the passband are lower. Development of these filters for a breadboard communications transponder confirms the theoretical results. Author (ESA)

N78-30504# Royal Aircraft Establishment, Farnborough (England).
A SHORT GUIDE TO HF GROUND WAVE CIRCUIT AVAILABILITY
R. M. Harris Jun. 1977 61 p refs
(RAE-TR-77081; BR59873) Avail: NTIS HC A04/MF A01

Atmospheric noise statistics presented by the CCIR were applied to the problem of circuit availability of an air to ground HF ground wave voice communications system. The best and worst case noise conditions were considered for a location in the United Kingdom. Curves are presented showing the expected ranges of the system in terms of its stipulated circuit availability. Means are provided whereby the results may be applied to air to ground or ground to ground systems generally, for the purpose of performance prediction. Ground wave radio propagation is reviewed and the statistical concept of circuit availability is explained in terms of the underlying noise characteristics. The limitations to the scope of the report are discussed and attention is drawn to problem areas; recommendations for further work are made. Author (ESA)

N78-30505# National Technical Information Service, Springfield, Va.
SPREAD SPECTRUM COMMUNICATIONS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Mar. 1978
William E. Reed May 1978 83 p
(NTIS/PS-78/0489/1) Avail: NTIS HC $28.00/MF $28.00 CSCL 17B

A bibliography containing 77 abstracts concerning the techniques, equipment, and applications of spread spectrum communications is presented. Topics include pseudonoise modulation, coding, signal processing, synchronization, antijamming, interference rejection, antennas, and the use of surface acoustic wave technology. Applications include satellite, televi-

sion, secure communication, multiples, and multiple access systems. GRA

N78-30506# National Technical Information Service, Springfield, Va.
SPREAD SPECTRUM COMMUNICATIONS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Mar. 1978
William E. Reed May 1978 82 p
(NTIS/PS-78/0490/9) Avail: NTIS HC $28.00/MF $28.00 CSCL 17B

A bibliography containing 74 abstracts concerning the techniques, equipment, and applications of spread spectrum communications is presented. Topics include pseudonoise modulation, coding, signal processing, synchronization, anti-jamming interference rejection, antennas, and the use of surface acoustic wave technology. Applications include satellite, secure communication, multiplex, and multiple access systems. GRA

N78-30507# National Technical Information Service, Springfield, Va.
CABLE TELEVISION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Apr. 1978
William E. Reed May 1978 140 p Supersedes NTIS/PS-77/0424; NTIS/PS-76/0412; NTIS/PS-75/404; COM-73-11675 (NTIS/PS-78/0492/5; NTIS/PS-77/0424; NTIS/PS-76/0412; NTIS/PS-75/404; COM-73-11675) Avail: NTIS HC $28.00/MF $28.00 CSCL 17B

A bibliography containing 135 abstracts concerning planning, uses, operation, and regulation of cable television systems is presented. Planning and utilization of CATV systems were studied in detail. GRA

N78-30508# National Technical Information Service, Springfield, Va.
CABLE TELEVISION, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1975 - Apr. 1978
William E. Reed May 1978 213 p Supersedes NTIS/PS-77/0425; NTIS/PS-76/0414
(NTIS/PS-78/0493/3; NTIS/PS-77/0425; NTIS/PS-76/0414) Avail: NTIS HC $28.00/MF $28.00 CSCL 17B

A bibliography containing 206 abstracts concerning the design, equipment, operation, use, and feasibility of cable television, is presented. Design and engineering studies, including research on modulators, interference, billing, distortion, antennas, and lightning and surge protection were examined in detail.GRA

N78-30509# National Technical Information Service, Springfield, Va.
MICROWAVE COMMUNICATION, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, Apr. 1976 - Apr. 1978
William E. Reed Jun. 1978 178 p Supersedes NTIS/PS-77/0466; NTIS/PS-76/0362; NTIS/PS-75/250
(NTIS/PS-78/0525/2; NTIS/PS-77/0466; NTIS/PS-76/0362; NTIS/PS-75/250) Avail: NTIS HC $28.00/MF $28.00 CSCL 17B

The techniques, equipment, reliability, and utilization of microwave communications are considered. Studies on microwave relays, links, data transmission, telemetry, satellite communications, multiplexing, and propagation are included. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N78-30510 Oklahoma State Univ., Stillwater.
SUBOPTIMAL CONTROL OF INTERCONNECTED POWER SYSTEMS Ph.D. Thesis
Panthep Laohachai 1977 163 p
Avail: Univ. Microfilms Order No. 78-11053

A method of suboptimal limited state feedback controller design for time invariant linear systems which offers a large reduction in the computational requirements was developed. The method is intended to be applied to interconnected power systems. In this method the system is divided into smaller subsystems so that necessary conditions for optimality can be presented as functions of these subsystems. With the use of a truncated Taylor series the suboptimal feedback gain of the control system can be obtained. The applications of the suboptimal method to a multi-area load frequency control system and a multimachine control system are studied. Dissert. Abstr.

N78-30511 Alabama Univ., University.
SECOND BREAKDOWN IN SIMPLE JUNCTION BIPOLAR DEVICES Ph.D. Thesis
David Mathews, III 1977 136 p
Avail: Univ. Microfilms Order No. 78-09867

Approximate solutions are given for a number of problems which arise in the analysis of second breakdown in junction bipolar devices. The purpose of these solutions is to provide a qualitative picture of device behavior and a method of checking more rigorous numerical analyses. Avalanche breakdown and sustaining voltages are shown for cylindrical and spherical geometries. Variation of bulk resistivity with temperature is demonstrated to be sufficient to cause a sharp drop in voltage, even without a current constriction. An inverse relationship between input power and time to failure is shown for high currents. An analysis of melt channel development is provided for both conventional and SOS structures. An improved equivalent circuit is suggested for current mode second breakdown.
Dissert. Abstr.

N78-30512 Florida Univ., Gainesville.
AN INVESTIGATION OF SOME PROPERTIES OF CARRIERS IN FIELD-EFFECT DEVICES Ph.D. Thesis
Lucien Maurice Rucker, III 1977 87 p
Avail: Univ. Microfilms Order No. 7810977

The behavior of several phenomena related to avalanching in the channel of Field-Effect Transistors (FETs) are studied. For sufficiently high drain-to-source potential in short channel FETs the majority carriers can gain enough energy to cause ionization upon impact with atoms in the crystal lattice. Such ionization results in generation of a carrier pair with the majority carrier continuing in the channel to enhance the drain current and the minority carrier being collected rapidly by the nearby depletion region to become part or all of the gate or substrate current. The results show that the entire gate current of Junction FETs (JFETs) is generated by the channel avalanching process when the device is operated at reduced temperature. The relation for noise associated with the JFET gate current generated by channel avalanching is adapted from earlier work on MOSFETs and is verified. Dissert. Abstr.

N78-30513 New Jersey Inst. of Technology, Newark.
RELIABILITY OF MOS DEVICES-THRESHOLD VOLTAGE INSTABILITY Ph.D. Thesis
Sesha Rajamani Shankar 1977 147 p
Avail: Univ. Microfilms Order No. 7801066

The effects of positive and negative gate bias stresses at elevated temperatures on the drift in the threshold voltage of MOS field effect transistors are examined. Over 400 p-channel enhancement mode devices were life tested under different temperature and gate bias conditions for periods of up to 15,000 hours, and the drift in their threshold voltages studied and analyzed. It was found that under both negative and positive bias-temperature tests, the threshold voltage drifted towards more negative values, though in the negative bias tests, the drift in the first few tens or hundreds of hours was in the opposite direction. Dissert. Abstr.

N78-30514 British Library Lending Div., Boston Spa (England).
ACTIVE RC-FILTERS WITH DISTRIBUTED RC-ELEMENTS
W. Buentig Mar. 1978 8 p refs Transl. into ENGLISH from Z. Elek. Inform. Energietech. (West Ger.), v. 7, no. 2, 1977 p 128-132
(BLL-RTS-11111) Avail: British Library Lending Div., Boston

Spa, Engl.: 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

Active filter circuits which contain systems with distributed parameters are analyzed. Circuits with homogeneous distributed RC two layer structures are considered. It is shown that by selecting a gain k and an RC product it is possible to obtain a definite limit frequency. In order to obtain other limit frequencies with the parameters already selected, it is necessary to incorporate additional lumped elements. Advantages of active distributed RC filters are: lower circuit expenditure; increased reliability; and greater influence of filter behavior by changing the circuits elements. J.M.S.

N78-30515 Stanford Univ., Calif.
MEASUREMENT OF THE RESIDUAL CHARGE ON SUPERCONDUCTING NIOBIUM SPHERES Ph.D. Thesis
George Sterling Larue 1978 112 p
Avail: Univ. Microfilms Order No. 7814183

Data from a superconducting magnetic levitation experiment provide evidence for the existence of fractional charge on matter. The smallest obtainable charge value, the residual charge q sub r, was measured on eight niobium balls. Three niobium balls heat treated on a tungsten substrate were found to have residual charges of (+0.324 + or - 0.009)e, (-0.001 + or - 0.025)e, and (-0.331 + or - 0.070)e. All five niobium balls heat treated on niobium substrates had residual charges near zero.
Dissert. Abstr.

N78-30516*# Varian Associates, Palo Alto, Calif.
THE 5K70SK AUTOMATICALLY TUNED, HIGH POWER, S-BAND KLYSTRON Final Report, 4 Dec. 1974 - 4 Mar. 1976
Art Goldfinger Mar. 1977 171 p
(Contracts NAS5-20601; NAS5-20307; NAS5-20375)
(NASA-CR-156798) Avail: NTIS HC A08/MF A01 CSCL 09A

Primary objectives include delivery of 44 5K70SK klystron amplifier tubes and 26 remote tuner assemblies with spare parts kits. Results of a reliability demonstration on a klystron test cavity are discussed, along with reliability tests performed on a remote tuning unit. Production problems and one design modification are reported and discussed. Results of PAT and DVT are included. G.Y.

N78-30517# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
A CIRCULAR WAVEGUIDE FEED FOR A PARABOLIC REFLECTOR ANTENNA [GUIA DE ONDAS CIRCULAR COMO ALIMENTADOR DE ANTENNA PARABOLICA]
Lucio Baptista Cividanes and Carlos Eduardo Santana Mar. 1978 25 p refs In PORTUGUESE; ENGLISH summary
(INPE-1203-PE/114) Avail: NTIS HC A02/MF A01

A detailed procedure outline for the design of a parabolic reflector antenna feed is given, with an analytical determination of its input resistance. Experimental measurement confirm the validity of the theory. G.G.

N78-30518# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
STUDY AND EVALUATION OF THE CALCULATION LEVEL FOR INTERMODULATION PRODUCTS IN A TRAVELING WAVE TUBE SIMULTANEOUSLY AMPLIFYING TWO OR MORE CARRIERS [ESTUDO E ENSAIOS EXPERIMENTAIS DA FORMACAO DE PRODUTOS DE INTERMODULACAO EM VALVULA DEONDA PROGRESSIVA OPERANDO COM DUAS O MAIS PORTADO RAS]
Epitacio Nascimento Filho Jun. 1978 71 p refs In PORTUGUESE; ENGLISH summary
(INPE-1280-NTE/123) Avail: NTIS HC A04/MF A01

A mathematical model of a travelling wave tube (TWT) is presented, for calculating the levels of intermodulation products, principally those of 3d order, when the tube is amplifying simultaneously two or more carriers, unmodulated or modulated is FM or PM. The model takes into account both the effect of non-linearity and the effect of conversion of amplitude to phase modulation. In short, this work takes into account the AM-PM conversion effect not computed by Sevy. Author

N78-30519# Council for Scientific and Industrial Research, Pretoria (South Africa). Geophysics Div.
RHO SUB 1 < RHO SUB 2. STANDARD GRAPHS. SCHLUMBERGER ELECTRICAL SOUNDINGS
S. J. Joubert [1977] 154 p refs In ENGLISH and AFRIKAANS
Avail: NTIS HC A08/MF A01

An album of electrical sounding curves for the Schlumberger array is presented. These sounding curves were compiled for the following purposes: (1) to satisfy a long felt need for two- and three-layer curves with large contrast in resistivity comparable to the geoelectrical conditions found in southern Africa and probably also in many other countries; (2) to provide a more comprehensive and evenly distributed set of three-layer curves than has hitherto been available; and (3) to include special families of three-layer curves (H and K types) and several families of four-layer curves (HK and KH types) for equal layer thickness. These curves were found to be very useful for interpreting field curves when the principle of equivalence applies and hence h the curve parameters are R (transverse resistance, hx rho) and/or C (longitudinal conductance, h/rho). G.Y.

N78-30520# Council for Scientific and Industrial Research, Pretoria (South Africa). Geographics Div.
RHO SUB 1 > RHO SUB 2. STANDARD GRAPHS. SCHLUMBERGER ELECTRICAL SOUNDINGS
S. J. Joubert [1977] 132 p refs In ENGLISH and AFRIKAANS
Avail: NTIS HC A07/MF A01
For abstract, see N78-30519.

N78-30521*# Westinghouse Defense and Electronic Systems Center, Baltimore, Md.
TIME DELAY AND INTEGRATION ARRAY (TDI) USING CHARGE TRANSFER DEVICE TECHNOLOGY. PHASE 2, VOLUME 1: TECHNICAL Final Report
21 Oct. 1977 102 p refs
(Contract NAS5-23629)
(NASA-CR-156807) Avail: NTIS HC A06/MF A01 CSCL 09A

The 20x9 TDI array was developed to meet the LANDSAT Thematic Mapper Requirements. This array is based upon a self-aligned, transparent gate, buried channel process. The process features: (1) buried channel, four phase, overlapping gate CCD's for high transfer efficiency without fat zero; (2) self-aligned transistors to minimize clock feedthrough and parasitic capacitance; and (3) transparent tin oxide electrode for high quantum efficiency with front surface irradiation. The requirements placed on the array and the performance achieved are summarized. This data is the result of flat field measurements only, no imaging or dynamic target measurements were made during this program. Measurements were performed with two different test stands. The bench test equipment fabricated for this program operated at the 8 micro sec line time and employed simple sampling of the gated MOSFET output video signal. The second stand employed Correlated Doubled Sampling (CDS) and operated at 79.2 micro sec line time. G.Y.

N78-30522*# Westinghouse Defense and Electronic Systems Center, Baltimore, Md.
TIME DELAY AND INTEGRATION ARRAY (TDI) USING CHARGE TRANSFER DEVICE TECHNOLOGY. PHASE 2, VOLUME 2: DATA Final Report
21 Oct. 1977 250 p
(Contract NAS5-23629)
(NASA-CR-156809) Avail: NTIS HC A11/MF A01 CSCL 09A
For abstract, see N78-30521.

N78-30523# Raytheon Co., Waltham, Mass. Research Div.
MANUFACTURING METHODS AND TECHNOLOGY MEASURE FOR ARC-PLASMA SPRAYED PHASE-SHIFTER ELEMENTS Final Technical Report, 27 Jun. 1975 - 15 Nov. 1977
J. J. Green, H. J. Vanhook, R. J. Maher, and D. Masse Dec. 1977 198 p refs
(Contract DAAB07-75-C-0043)
(AD-A054271; S-2287) Avail: NTIS HC A09/MF A01 CSCL 09/5

The Phased-array radar antenna is now well established as a means of achieving agile search and multi-target tracking in the current and projected military government. Each new system with its phased-array antenna has many thousands of radiating elements. Since each element contains a ferrite phase shifter, it is appropriate to develop manufacturing methods and processes that will minimize the cost of each phase shifter. The purpose of this program is to develop a manufacturing capability for producing a c-band phase-shifter element by arc-plasma spraying of a lithium-titanium ferrite onto a dielectric substrate. In this process, a high temperature diffusion bond between the toroidal envelope and dielectric core permanently mates the ceramic parts, thus eliminating the need for any joining material. The switching wires are threaded through interior slots after final machining and can be replaced or renewed at any time. The primary objective is to produce the phase control element as a finished composition with acceptable microwave properties and a reasonably high yield. To achieve sound composites, one of the properties needing constant monitoring is the match in thermal expansion coefficient between the ferrite coating and the dielectric. Author (GRA)

N78-30524# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Electrical and Systems Engineering.
RECURSIVE ESTIMATION WITH NON-HOMOGENEOUS IMAGE MODELS Interim Report
Vinay K. Ingle, Assad Radpour, John Woods, and Howard Kaufman 1978 5 p refs
(Grant AF-AFOSR-3361-77; AF Proj. 2304)
(AD-A054115; AFOSR-78-0817TR) Avail: NTIS HC A02/MF A01 CSCL 09/4

This paper presents initial results on spatially variant recursive estimation of images. Parameters of block-wise constant recursive model are identified on noise free data. The models are then used to design reduced update Kalman filters which are applied to noisy data. The results are presented and discussed.
Author (GRA)

N78-30525# Harry Diamond Labs., Adelphi, Md.
EXTENSIONS OF MODELS FOR TRANSISTOR FAILURE
Joseph V. Michalowicz and George A. Ausman, Jr. Apr. 1978 24 p refs
(DNA MIPR 76550)
(AD-A054439; HDL-TR-1830) Avail: NTIS HC A02/MF A01 CSCL 09/1

Models developed in the Hardening Options for Neutron Effects (HONE) program for predicting transistor failure probability are extended to include probability distributions for the initial current gains and to allow nonzero origins for all random variables concerned. Further, these models are generalized to consider two-transistor combinations. Test cases are calculated to compare the failure probability curves generated by these models with previous results. Author (GRA)

N78-30526# Army Electronics Research and Development Command, Fort Monmouth, N. J. Electronics Technology/Devices Lab.
PROPERTIES OF COMPOSITE MAGNETIC COMPONENTS FOR USE WITH HEMAC
Robert D. Finnegan, Robert O. Savage, Jr., Joseph Megill, Arthur Tauber, and Kurt Ikrath Jan. 1978 71 p refs
(DA Proj. 1L1-61102-AH-47; DA Proj. 1T1-61102-B-31A)
(AD-A054280; DELET-TR-78-3) Avail: NTIS HC A04/MF A01 CSCL 20/3

Hybrid electromagnetic antenna couplers (HEMAC) offer the advantage of using convenient parts of the environment as antennas. In this report the synthesis and evaluation of flexible, shock-resistant, magnetic composites for use at high frequency in HEMAC coils and their characterization are described. Ferrites and carbonyl iron were cast into desired form using silicone as a matrix material. The complex impedance of the samples in the form of a coaxial line was measured from 1-100 MHz. The characteristic impedance, resistance, reactance, complex permeability and complex permittivity, and losses were computed. The real part of the permeability for all materials was found to be equal to the reciprocal of the cube of the porosity up to 100 MHz, where p is the porosity. An experimental toroid mounted in a HEMAC on a simulated rifle exhibited improved characteristics.
Author (GRA)

N78-30527# Naval Surface Weapons Center, White Oak, Md.
AN IMPROVED TRANSLATING FILTER DESIGN Final Report
Arthur D. Delagrange Nov. 1977 31 p refs
(AD-A054613; NSWC/WOL/TR-77-172) Avail: NTIS HC A03/MF A01 CSCL 09/5

The translating filter is a new device developed at NSWC which gives an extremely steep attenuation slope at a variable but extremely accurate cutoff frequency. This is accomplished by using fixed filters and moving the signal frequency spectrum by frequency translation techniques. This report gives a complete description of an improved version of the device.
Author (GRA)

N78-30528# Varian Associates, Palo Alto, Calif. Light Sensing and Emitting Div.
ELECTRON BOMBARDED SEMICONDUCTOR CHARGE COUPLED DEVICE (EBS-CCD) CAMERA TUBE WITH GaAs PHOTOCATHODE PROXIMITY FOCUSED DIODE Final Report, Sep. 1976 - Jul. 1977
Stephen D. Sparks, Wayne G. Abraham, and Gilbert F. Gwilliam Nov. 1977 36 p
(Contract DAAK70-76-C-0236)
(AD-A054230) Avail: NTIS HC A03/MF A01 CSCL 09/1

This final report describes design, development and fabrication of proximity focused imaging photodiodes known as electron bombarded semiconductor-charge coupled device (EBS-CCD) camera tubes. These ultra high vacuum devices consist of a flat gallium arsenide (GaAs) semitransparent photocathode (one of a class of III-V photocathodes) and a thinned-back charge coupled device (CCD) operated as an intensified charge coupled device (ICCD) in close proximity to each other. Author (GRA)

N78-30529# Rockwell International Science Center, Thousand Oaks, Calif.
DEVELOPMENT OF CHARGE TRANSFER DEVICES FOR 1-2 MICRON IMAGING Quarterly Technical Report, 10 May - 10 Aug. 1977
5 Oct. 1977 54 p refs
(Contract DAAK70-77-C-0109)
(AD-A054250; SC5111.2QTR; QTR-1) Avail: NTIS HC A04/MF A01 CSCL 17/5

There are a number of military applications for a passive (available illumination) night vision capability. Technological advances in image intensifiers and high performance photocathodes have resulted in night vision systems which operate in the visible and near infrared spectrum under low level moonlight and starlight illumination. These systems are, however, completely ineffective under moonless or overcast conditions because of the low level of light in the 0.5-0.9 micron region under such conditions. Since there is considerable night glow ambient illumination in the 1.0-1.8 micron wavelength region which is nearly independent of cloud-cover, one solution to this problem is the development of an imaging system which operates in this wavelength region. The approach that we are pursuing in this program is the development of a non-mis heterojunction CCD in a narrow gap semiconductor. GRA

N78-30530# Catholic Univ. of America, Washington, D. C.
RECOVERY MEASUREMENTS OF A CRITICAL CURRENT AT A PHASE SLIP SITE Final Report
Robert A. Peters 29 Sep. 1977 15 p refs
(Contract N00014-76-C-0845)
(AD-A054153) Avail: NTIS HC A02/MF A01 CSCL 20/3

The final report includes measurements of the time for the recovery of the critical current at a phase slip site. They have been made by studying the frequency dependence of the hysteretic rf current-voltage characteristics in the low power limit. The data are explicable by a simple quasiparticle diffusion model and are incompatible with recent hot spot models. Author (GRA)

N78-30531# Syracuse Univ., N. Y. Dept. of Mechanical and Aerospace Engineering.
CRITIQUE OF THE CENTRIFUGE AS A STRESSING DEVICE Final Technical Report

Charles Libove May 1978 36 p refs
(Contract F30602-75-C-0121)
(AD-A054946; MAE-1229-T-2; RADC-TR-78-102) Avail: NTIS HC A02/MF A01 CSCL 09/1

The results of this study provide mathematical relationships to theoretically assess the capabilities of the centrifuge test as a stressing device for the following microelectronic components: wires and wire bonds, chip and substrate attachment, lids and bases of rectangular flat-packs. The results of the study suggest that the centrifuge is of marginal utility as a stressing device for the above mentioned components. Author (GRA)

N78-30532# Harris Corp., Melbourne, Fla. Electronic Systems Div.
GROUNDING REQUIREMENTS FOR PROTECTION OF TRANSPORTABLE SATELLITE COMMUNICATION TERMINALS
W. J. Getson Aug. 1977 41 p refs
(Contract W-7405-eng-48-EC-301)
(PEM-59) Avail: NTIS HC A03/MF A01

Existing theoretical and experimental knowledge concerning grounding requirements for the protection of structures in general can be implemented for the special case of the transportable SATCOM terminal. A description of a typical SATCOM terminal and terminal specifications are presented. General protection requirements are that transportable SATCOM terminals: must meet performance requirements, must not be damaged by direct lightning strokes, must not be degraded beyond allowable tolerances due to effects of an electromagnetic pulse (EMP), and must be safe for personnel working in and around the terminal. An adequate grounding system is described, including a description of site fields. Lightning protection for antenna structures, equipment shelters, combined protection, power modules, and electrical surge arrestors are covered, as is EMP protection for antenna structures, equipment shelters, and power modules, with emphasis on electrical surge arrestors, cable shields and connectors, and cable routing. Examples of grounding systems for two configurations of transportable SATCOM terminals are compared. ERA

N78-30533# Bendix Corp., Kansas City, Mo.
HMC-TO-FLATPACK ATTACHMENT
L. R. Zawicki Apr. 1978 21 p
(Contract EY-76-C-04-0613)
(BDX-613-1800-Rev) Avail: NTIS HC A02/MF A01

A method was developed for attaching a completed hybrid microcircuit to a flatpack which can then be hermetically sealed. Ablefilm 517B and Epo-Tek H77 epoxies, in conjunction with an abraded flatpack and applied pressure during cure, were shown to provide HMC-to-flatpack bonds which meet all environmental and processing requirements of hybrid microcircuits. ERA

N78-30534# Bendix Corp., Kansas City, Mo.
FABRICATION AND PERFORMANCE OF A LAMINATED NONVOLATILE NONDESTRUCTIVE READOUT MEMORY CORE Final Report
H. F. Jordon, Jr. Mar. 1978 19 p refs
(Contract EY-76-C-04-0613)
(BDX-613-1763) Avail: NTIS HC A02/MF A01

A technique was developed for the fabrication of 5.08 mm diameter cores using 0.025 or 0.013 mm thick magnetic sheet material. The technique uses the photoresist used in the photochemical etching process to serve as the adhesive as well. A test technique for the nondestructive readout characteristics of the cores was also developed. ERA

N78-30535# Bendix Corp., Kansas City, Mo.
SEMICONDUCTOR DIE ATTACHMENT Final Report
L. R. Zawicki Apr. 1978 16 p
(Contract EY-76-C-04-0613)
(BDX-613-1809-Rev) Avail: NTIS HC A02/MF A01

A technique was established for attaching nonbeam lead semiconductor devices to metallized ceramic substrates for hybrid microcircuits (HMCs). Conductive and nonconductive epoxies were shown to be capable of high shear strengths after exposure to high temperatures (125 to 200 C) for significant periods of time (48 to 168 h). Chip-on-tab devices attached to the substrate with Ablefilm 517 nonconductive epoxy was the technology chosen. ERA

N78-30536# Sandia Labs., Albuquerque, N. Mex. Passive Components Div.
DISCHARGE LIFE OF MYLAR
Douglas H. Loescher Mar. 1978 37 p refs
(Contract EY-76-C-04-0789)
(SAND-77-1911) Avail: NTIS HC A03/MF A01

The time of failure was determined for Mylar capacitors subjected to repeated charge-discharge cycles. The capacitors tested were unimpregnated Mylar film capacitors similar to those used as the main energy storage element in a variety of Sandia designed fire sets. The effects on life of capacitor design, fabrication, and operation were investigated. It is found that multiple layer designs have as long or longer lives than single layer of Mylar designs. Winding at intermediate to high film tension and processing at 80 C result in greater life than do loose winding or processing at 100 C. Evidence is found against the use of a burn-in to improve reliability, but data supporting the use of a high voltage screen are presented. It was found that life decreases rapidly as the applied voltage, electric field, and reversal ratio increase. It is shown that variation of peak current has little effect on life. Life is also little affected by operation at temperatures up to 74 C. ERA

N78-30537# Los Alamos Scientific Lab., N. Mex.
GYROCON: A DEFLECTION-MODULATED, HIGH-POWER MICROWAVE AMPLIFIER
Paul J. Tallerico Oct. 1977 23 p refs
(Contract W-7405-eng-36)
(LA-6907) Avail: NTIS HC A02/MF A01

A large-signal, relativistic theory of the electron-field interaction in a new class of microwave amplifiers is presented and applied to the analysis of a high power, 450 MHz amplifier for accelerator applications. The analysis indicates that electronic efficiencies in excess of 90 percent are obtainable and that overall efficiencies of 90 percent are possible. The amplifier is unique in several respects; the electron velocity is perpendicular to the circuit energy flow, the device uses a fast-wave circuit, and the electron beam is deflection modulated. ERA

N78-30538# Los Alamos Scientific Lab., N. Mex.
CLASS OF DEFLECTION-MODULATED, HIGH-POWER MICROWAVE AMPLIFIERS
Paul J. Tallerico 1977 5 p refs Presented at IEEE Intern. Electron Devices Meeting, Washington, D. C., 5-7 Dec. 1977
(Contract W-7405-eng-36)
(LA-UR-77-2255; Conf-771201-1) Avail: NTIS HC A02/MF A01

An unusual deflection-modulated, fast-wave electron device is analyzed. It has several unique properties; the electron beam is unbunched and is perpendicular to the direction of power flow in the circuit, and the circuit could be a simple fundamental-mode rectangular waveguide. The amplifier consists of an electron gun, a deflection cavity, an optional beam-bending system, and an output interaction region. An idealized theory showing that 100 percent electronic efficiency may be achieved, and several large-signal calculations with over 90 percent electronic and circuit efficiencies, are presented. The power, gain, and frequency limits to this type of amplifier or frequency multiplier are discussed. The beam power must be greater than 100 kW for efficient operation. The devices operate best at frequencies below a few gigahertz because of limitations on the ratio of beam size to circuit size. The power gains vary between 10 and 25 db. ERA

N78-30539# Oak Ridge National Lab., Tenn.
IMPROVED UNITARY AND MULTICOMPONENT GASEOUS INSULATORS
M. O. Pace, L. G. Christophorou, D. R. James, R. Y. Pai, R. A. Mathis, and D. W. Bouldin 1977 21 p refs Presented at Conf. on Elec./Electron. Insulation, Chicago, 26 Sep. 1977
(Contract W-7405-eng-26)
(CONF-770981-1) Avail: NTIS HC A02/MF A01

Improved unitary and multicomponent gaseous insulators are systematically designed according to detailed knowledge of fundamental electron-molecule interactions. Knowledge of the

electron attachment and electron slowing-down properties of dielectric gases/mixtures as functions of electron energy is shown to be especially significant. On the basis of such knowledge it is possible to improve the gaseous dielectric's breakdown strength by effectively controlling the numbers and energies of the electrons present. Several unitary (e.g., C4F6, c-C4F8, and iso-C4F8) and multicomponent (e.g., C4F6/SF6/N2 and c-C4F6/SF6/N2) gaseous systems have been tested and found to have better DC breakdown strength properties than SF6. These findings are reported and discussed. ERA

N78-30540# Los Alamos Scientific Lab., N. Mex.
ELECTRONIC RESEARCH, INCLUDING LIVESTOCK TEMPERATURE MONITORING, ELECTROMAGNETIC PROBING, AND JOSEPHSON JUNCTION SWITCHING DEVICES Semiannual Report, 1 Jun. 1977 - 31 Dec. 1977
P. A. Kelly, comp. Mar. 1978 96 p refs
(Contract W-7405-eng-36)
(LA-7149-PR) Avail: NTIS HC A05/MF A01

The status of the programs and projects of the Electronics Division is reported for the period of June through December 1977. The presentation is divided into three sections: Research, Engineering Support, and Technical Services. Each of these sections presents the activities and accomplishments of the corresponding branch within the Division. Among the subject areas included are the following: radiation detectors, temperature monitoring, electromagnetic probing, Josephson junction switching devices, fiber optics, high-temperature electronics HVAC systems, microprocessors, fuel cell-powered vehicles, laser fusion. ERA

N78-30541# Oak Ridge National Lab., Tenn.
FINITE ELEMENT STRESS ANALYSIS OF ORTHOTROPIC SOLENOIDS
W. H. Gray and J. E. Akin (Tennessee Univ., Knoxville) 1977 5 p refs Presented at 7th Symp. on Fusion Res. Project, Knoxville, Tenn., 25 Oct. 1977
(Contract W-7405-eng-26)
(CONF-771029-61) Avail: NTIS HC A02/MF A01

The mechanical behavior of superconducting magnets deviates from isotropy due to their construction techniques, which involve the layering of superconductor, insulation, and sometimes structural reinforcement within the windings. This paper describes a finite element stress analysis which has been extended to consider the effects of orthotropic material properties, as well as differential thermal contraction and spatially varying magnetic body forces. The procedure is applicable to all arbitrarily shaped axisymmetric magnets. A comparison between the finite element stress analysis and an analytical solution for a rotationally transversely isotropic solenoid is presented. Good agreement is obtained within the limits of the analytical solution. ERA

N78-30542# Oak Ridge National Lab., Tenn.
EFFECT OF A CONTINUOUS RESISTIVE TRANSITION ON SELF-FIELD INSTABILITY
L. Dresner 1977 4 p refs Presented at 7th Symp. on Fusion Res. Project, Knoxville, Tenn., 25 Oct. 1977
(Contract W-7405-eng-26)
(CONF-771029-19) Avail: NTIS HC A02/MF A01

Composite superconductors develop resistance continuously rather than suddenly as transport current increases. This means that the distribution of current among the filaments in a composite conductor is determined not only by their inductive coupling but also by the longitudinal resistance they develop as they began to carry current. The current distribution was calculated taking into account the continuous nature of the resistive transition for a composite being charged at a uniform rate. The results show that slowly charged conductors are much more stable against self-field instability than is indicated by purely inductive calculations. ERA

N78-30543# Centre National d'Etudes Spatiales, Toulouse (France).
WIRE INTERCONNECTION OF ELECTRONIC COMPONENTS [INTERCONNEXION PAR FIL DES COMPOSANTS ELECTRONIQUES]
Daniel Hernandez Dec. 1977 25 p refs In FRENCH; ENGLISH summary
(CNES-NT-79) Avail: NTIS HC A02/MF A01

Some basic elements for wire-interconnection of electronic parts are given. The main technologies, the rules for a good bonding, the defect that can be encountered in this type of connection, and the maladies related to these bondings are described. The study is mostly a result of a bibliographical investigation confirmed by experience of the French Space Center. Author (ESA)

N78-30544# Fulmer Research Inst. Ltd., Stoke Poges (England).
RADIATION EFFECTS. ENGINEERING HANDBOOK (METHODS OF IMPROVING THE RADIATION TOLERANCE OF ELECTRONICS IN SPACE VEHICLES) Final Report
Andrew Holmes-Siedle and Roger Freeman Paris ESA Apr. 1978 482 p refs
(Contract ESTEC-2871/76-NL-HP)
(FRI-R730/8; ESA-CR(P)-1067) Avail: NTIS HC A21/MF A01

Space radiation effects in electronic subsystems are discussed. Useful data from a wide range of sources are presented and methods which have been newly developed to provide engineering solutions to the problem of degradation of devices in space are described. The new developments include a simple model for analyzing space-charge buildup in MOS devices, a ranking scheme for CMOS - LSI circuits and improved dose transmission curves and tradeoff curves for spacecraft life against shield weight. A complete analysis of a piece of spacecraft equipment is given. Recommendations for future progress in hardness engineering are made. Author (ESA)

N78-30409# Fiat Research Center, Orbassano (Italy).
FIAT ELECTRIC CITY CAR PROTOTYPE
G. Brusaglino *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 846-854 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30412# Varta A.G., Frankfurt am Main (West Germany).
PERIPHERAL EQUIPMENT FOR REDUCING MAINTENANCE OF ELECTRIC VEHICLE LEAD-ACID BATTERIES
K. Salamon *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 876-889 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30413# General Research Corp., Santa Barbara, Calif.
PERFORMANCE STANDARDS FOR ELECTRIC VEHICLES
J. Brennand *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 891-901 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30417# California Univ., Livermore. Lawrence Livermore Lab.
A SYSTEMATIC APPROACH TO THE EVOLUTION OF HIGH PERFORMANCE ELECTRIC VEHICLES
L. G. OConnell *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 942-948 (For primary document see N78-30370 21-31)
(CONF-770430-1) Avail: NTIS HC A22/MF A01

N78-30418# General Electric Co., Schenectady, N. Y.
DESIGN OF A CURRENT TECHNOLOGY ELECTRIC VEHICLE
Robert H. Guess *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 948-968 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30831# Joint Publications Research Service, Arlington, Va.
TEN YEARS OF WORK ON ELECTRONIC EQUIPMENT FOR THE INTERKOSMOS PROGRAM BY TESLA
Eng Vaclav Grim *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 46 (JPRS-71727) 22 Aug. 1978 33-44 Transl. into ENGLISH from Rev. Obchodu/Prumyslu/Hospodarstvi (Prague), no. 5, 1978 p 12-15 (For primary

document see N78-30827 21-59)
Avail: NTIS HC A05/MF A01

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N78-30545 Alabama Univ., University.
ANALYSIS OF FLUID-STRUCTURE INTERACTION UNDER HYDRODYNAMIC SHOCK CONDITIONS BY THE FINITE ELEMENT METHOD Ph.D. Thesis
John Elwin Jackson 1977 135 p
Avail: Univ. Microfilms Order No. 7809861

Results are presented for the one-dimensional problem of a shock wave propagating through a fluid and impinging on a simple spring-mass system. Calculations for the dynamic response of the mass show that the interaction effect between fluid and structure can cause large deviations in both maximum displacement and period of oscillation when compared to the response predicted by neglecting interaction effects. The magnitude of the error caused by neglecting interaction effects is shown to be dependent on the relative values of the mass and stiffness of the solid and the density of the surrounding fluid medium. Dissert. Abstr.

N78-30546 Cornell Univ., Ithaca, N. Y.
THE EFFECT OF VELOCITY ON THE COALESCENCE OF LIQUID DROPS IMPACTING A LIQUID-LIQUID INTERFACE Ph.D. Thesis
David Bradley Clark 1978 179 p
Avail: Univ. Microfilms Order No. 78-09791

The coalescence of tetrachloroethylene drops impacting a water-tetrachloroethylene interface at velocities up to 80 cm/sec was studied with high-speed conemaphotography in order to determine the effect of velocity on the coalescence process and to investigate the existence of rapid coalescence. A specially designed drop-forming nozzle was used to generate drops with independent variable and reproducible sizes and velocities in a highly contamination-free and vibration-free apparatus thermostated at 30.0 C. Two different modes of coalescence behavior could be distinguished by whether a drop bounced away from the interface after impact, either partially or completely losing contact, or maintained complete contact and oscillated with the interface. The existence of a critical velocity for rapid coalescence is discussed. Dissert. Abstr.

N78-30547*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
FILLING OF ORBITAL FLUID MANAGEMENT SYSTEMS Final Report, Aug. 1977 - Mar. 1978
E. C. Cady and H. H. Miyashiro Aug. 1978 85 p refs
(Contract NAS3-21022)
(NASA-CR-159405; MDC-G-7374) Avail: NTIS HC A05/MF A01 CSCL 20D

The gravity-dependent refill phenomena was studied for a small-scale tank containing a screen acquisition device suitable for a Spacelab cryogenic fluid management experiment. The analysis considers chilldown, interface stability, screen device and tank filling processes, ullage pressure control, and venting. The processes involved in low-g filling were examined and modelling techniques, appropriate to the experimental evaluation of critical filling phenomena, were defined as well as the overall ground and low-g experimental program. G.G.

N78-30548*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HEAT TRANSFER DISTRIBUTIONS INDUCED BY ELEVON DEFLECTIONS ON SWEPT WINGS AND ADJACENT SURFACES AT MACH 6
Charles B. Johnson and Louis G. Kaufman, II (Grumman Aerospace Corp., Bethpage, N. Y.) Aug. 1978 106 p refs
(NASA-TM-74045; L-11461) Avail: NTIS HC A06/MF A01 CSCL 20D

Surface heat transfer distributions are presented for swept wing semispan models having trailing edge elevon ramp angles of 0, 10, 20, and 30 degrees. The wing sweepback angles are 0, 50, and 70 degrees. The models have attachable cylindrical and flat plate center bodies and various attachable wing-tip fins. The data, obtained for a 0 degree angle of attack, a free stream Mach number of 6, and a wing root chord Reynolds number of about 17,000,000, reveal considerably larger regions of elevon induced thermal loads on adjacent surfaces than would be suggested by fully attached flow analyses. Author

N78-30549*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SIZING-TUBE-FIN SPACE RADIATORS
Jerry A. Peoples Jul. 1978 29 p refs
(NASA-TM-78185) Avail: NTIS HC A03/MF A01 CSCL 20D

Temperature and size considerations of the tube fin space radiator were characterized by charts and equations. An approach of accurately assessing rejection capability commensurate with a phase A/B level output is reviewed. A computer program, based on Mackey's equations, is also presented which sizes the rejection area for a given thermal load. The program also handles the flow and thermal considerations of the film coefficient. B.B.

N78-30550# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
APPLICATION OF A NEW PARTLY-IMPLICIT TIME-DIFFERENCING SCHEME FOR SOLVING THE SHALLOW-WATER EQUATIONS
I. M. Navon Sep. 1977 36 p refs
(CSIR-SR-WISK-278; ISBN-0-7988-1195-1) Avail: NTIS HC A03/MF A01

Nonlinear shallow-water equations are soloed for a limited-area domain employing a semi-momentum space-differencing scheme. Numerical integration was performed with time steps 2.5 times as large as the greatest allowed for by the CFL (Courant, Friedrichs and Levy) criterion for the leap-frog explicit scheme. It is shown that an unconditionally stable scheme can be obtained by coupling implicitly the continuity equation and one of the momentum equations. Numerical experiments with the barotropic equations were performed in a channel and in combination with coarse-mesh data, using the partly implicit scheme with well-posed boundary conditions. Integral invariants of the shallow-water equations conserved well during the numerical integrations. G.G.

N78-30551*# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
ANALYSIS OF TURBULENT FREE JET HYDROGEN-AIR DIFFUSION FLAMES WITH FINITE CHEMICAL REACTION RATES Final Report
J. P. Sislian Aug. 1978 58 p refs
(Contract NAS1-14843)
(NASA-CR-3024; UTIAS-224) Avail: NTIS HC A04/MF A01 CSCL 20D

The nonequilibrium flow field resulting from the turbulent mixing and combustion of a supersonic axisymmetric hydrogen jet in a supersonic parallel coflowing air stream is analyzed. Effective turbulent transport properties are determined using the (K-epsilon) model. The finite-rate chemistry model considers eight reactions between six chemical species, H, O, H2O, OH, O2, and H2. The governing set of nonlinear partial differential equations is solved by an implicit finite-difference procedure. Radial distributions are obtained at two downstream locations of variables such as turbulent kinetic energy, turbulent dissipation rate, turbulent scale length, and viscosity. The results show that these variables attain peak values at the axis of symmetry. Computed distributions of velocity, temperature, and mass fraction are also given. A direct analytical approach to account for the effect of species concentration fluctuations on the mean production rate of species (the phenomenon of unmixedness) is also presented. However, the use of the method does not seem justified in view of the excessive computer time required to solve the resulting system of equations. Author

N78-30552*# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
EQUATIONS OF MOTION AND TWO-EQUATION TURBU-

LENCE MODEL FOR PLANE OR AXISYMMETRIC TURBULENT FLOWS IN BODY-ORIENTED ORTHOGONAL CURVILINEAR COORDINATES AND MASS-AVERAGED DEPENDENT VARIABLES Final Report

J. P. Sislian Aug. 1978 49 p refs

(Contract NAS1-14843)

(NASA-CR-3025; UTIAS-225) Avail: NTIS HC A03/MF A01 CSCL 20A

The full Navier-Stokes time-dependent, compressible, turbulent, mean-flow equations in mass-averaged variables for plane or axisymmetric flow are presented. The equations are derived in a body-oriented, orthogonal, curvilinear coordinate system. Turbulence is modelled by a system of two equations for mass-averaged turbulent kinetic energy and dissipation rate proposed. These equations are rederived and some new features are discussed. A system of second order boundary layer equations is then derived which includes the effects of longitudinal curvature and the normal pressure gradient. The Wilcox and Chambers approach is used in considering effects of streamline curvature on turbulence phenomena in turbulent boundary layer type flows. Their two-equation turbulence model with curvature terms are rederived for the cases considered in the present report. The derived system equations serves as a basis for an investigation of problems where streamline curvature is of the order of the characteristic length in the longitudinal direction. G.Y.

N78-30553*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.

COMPUTATION OF THREE-DIMENSIONAL NOZZLE-EXHAUST FLOW FIELDS WITH THE GIM CODE Final Report

Lawrence W. Spradley and P. G. Anderson Aug. 1978 74 p refs

(NASA Order L-53289-A; NASA Order L-68133-A)

(NASA-CR-3042; LMSC-HREC-TB-D477112-A) Avail: NTIS HC A05/MF A01 CSCL 20D

A methodology is introduced for constructing numerical analogs of the partial differential equations of continuum mechanics. A general formulation is provided which permits classical finite element and many of the finite difference methods to be derived directly. The approach, termed the General Interpolants Method (GIM), can combined the best features of finite element and finite difference methods. A quasi-variational procedure is used to formulate the element equations, to introduce boundary conditions into the method and to provide a natural assembly sequence. A derivation is given in terms of general interpolation functions from this procedure. Example computations for transonic and supersonic flows in two and three dimensions are given to illustrate the utility of GIM. A three-dimensional nozzle-exhaust flow field is solved including interaction with the freestream and a coupled treatment of the shear layer. Potential applications of the GIM code to a variety of computational fluid dynamics problems is then discussed in terms of existing capability or by extension of the methodology. Author

N78-30554*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

TURBULENT-FLOW SEPARATION CRITERIA FOR OVEREXPANDED SUPERSONIC NOZZLES

E. Leon Morrisette and Theodore J. Goldberg Aug. 1978 39 p refs

(NASA-TP-1207; L-11530) Avail: NTIS HC A03/MF A01 CSCL 20D

A comprehensive compilation of available turbulent flow separation data for overexpanded supersonic nozzles is presented with a discussion of correlation techniques, and prediction methods. Data are grouped by nozzle types: conical, contoured, and two dimensional wedge. Correlation of conical nozzle separation is found to be independent of nozzle divergence half-angle above the 9 deg, whereas the contoured nozzle data follow a different correlation curve. Zero pressure gradient prediction techniques are shown to predict adequately the higher divergence angle conical separation data, and an empirical equation is given for the contoured nozzle data correlation. Flow conditions for which the correlations are invalid are discussed and bounded. A nozzle boundary layer transition criterion is presented which can be used to show that much of the noncorrelating data in the literature are concerned with nonturbulent separation and which explains the previously reported external flow effects on nozzle separation. Author

N78-30555*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

REINFORCED CARBON-CARBON OXIDATION BEHAVIOR IN CONVECTIVE AND RADIATIVE ENVIRONMENTS

Donald M. Curry, K. J. Johansen (Vought Corp., Dallas), and Emily W. Stephens Aug. 1978 31 p refs

(NASA-TP-1284; S-485) Avail: NTIS HC A03/MF A01 CSCL 20D

Reinforced carbon-carbon, which is used as thermal protection on the space shuttle orbiter wing leading edges and nose cap, was tested in both radiant and plasma arcjet heating test facilities. The test series was conducted at varying temperatures and pressures. Samples tested in the plasma arcjet facility had consistently higher mass loss than those samples tested in the radiant facility. A method using the mass loss data is suggested for predicting mission mass loss for specific locations on the Orbiter. S.E.S.

N78-30556# California Inst. of Tech., Pasadena. Guggenheim Jet Propulsion Center.

MEASUREMENTS OF ENERGY LOSSES ASSOCIATED WITH INTERACTIONS BETWEEN ACOUSTIC WAVES AND A STEADY FLOW FIELD Final Report, 16 Mar. 1976 - 15 Nov. 1977

F. E. C. Culick and K. Magiawala Mar. 1978 80 p refs

(Contract F04611-75-C-0100)

(AD-A054532; AFRPL-TR-78-6) Avail: NTIS HC A05/MF A01 CSCL 20/4

An experimental program has been conducted to study interactions between acoustic waves and non-uniform flow fields. Data have been taken in an impedance tube, modified to accommodate an average flow, and in a resonance tube. Results are given for the influence of flow through a subsonic exhaust vent on an acoustic field. Measurements for circular and slot vents of several sizes and for two frequencies show that the flow through the vent causes a transfer of energy from the average flow field to the acoustic field: The vent acts as a source or gain of acoustic energy. Author (GRA)

N78-30557# Los Alamos Scientific Lab., N. Mex.

NONLINEAR HYDRODYNAMIC FORCES ON FLOATING BODIES

B. D. Nichols and C. W. Hirt 1977 4 p refs Presented at 2d Intern. Conf. on Numerical Ship Hydrodynamics, Berkeley, Calif., 19 Sep. 1977

(LA-UR-77-437; Conf-770910-1) Avail: NTIS HC A02/MF A01

Two- and three-dimensional SOLA codes were used to investigate nonlinear and three-dimensional effects influencing the hydrodynamic forces on floating cylinders. In particular, nonlinear effects arising during large amplitude swaying motions of a two-dimensional 60 deg triangular cylinder are presented. The results of the numerical studies are compared with data and an interpretation of the observed nonlinear effects is discussed. A second study is presented that compares two- and three-dimensional calculations of the triangular cylinder in sway. Here the end effects associated with finite length cylinders are noted. Nonlinear finite amplitude effects for the three-dimensional triangular cylinder are also studied. Finally, some results are presented for other nonlinear forces experienced by cylinders in two- and three-dimensional situations. ERA

N78-30558# California Univ., Berkeley. Lawrence Berkeley Lab.

ONE DIMENSIONAL-TWO PHASE PARTICULATE FLOW M.S. Thesis

D. M. Kleist Sep. 1977 93 p refs

(Contract W-7405-eng-48)

(LBL-6967) Avail: NTIS HC A05/MF A01

A computer model which predicts the velocity of solid particles entrained in a one-dimensional gas stream, was modified to improve its accuracy and extend the range of velocity prediction. The program was also used to demonstrate the effects that initial particle velocity and particle concentration have on velocity predictions. The accuracy of the model was confirmed by

comparing the theoretical predictions with experimentally measured velocities of particles varying in size, shape and density. For all cases where test data could be measured accurately, the theoretical predictions were in good agreement with the average experimental values. ERA

N78-30559# California Univ., Berkeley. Lawrence Berkeley Lab.
SOME PROPERTIES OF CAPILLARY SURFACES ON ELLIPTICAL DOMAINS
N. Albright 1977 18 p refs
(Contract W-7405-eng-48)
(LBL-6137) Avail: NTIS HC A02/MF A01

It is shown that there will exist a critical contact angle for an elliptical cross section if the ratio b/a of the minor and major semiaxes is less than 0.6116. There is no solution of the capillary surface equations for contact angles less than the critical angle. A lower bound on gamm/sub crit/ is calculated for various values of b/a. These bounds appear to be close to the values of gamma/sub crit/ found by numerical solution of the capillary surface equations. ERA

N78-30560# Delft Hydraulics Lab. (Netherlands).
MATHEMATICAL MODELS FOR SIMPLE HARMONIC LINEAR WATER WAVES: WAVE DIFFRACTION AND REFRACTION Ph.D. Thesis - Tech. Hogeschool Delft, Neth.
J. C. W. Berkhoff Apr. 1976 117 p refs
(Publ-163) Avail: NTIS HC A06/MF A01

Three mathematical models for water wave propagation in the horizontal plane are discussed: diffraction, refraction, and combined refraction/diffraction. The models are based on the simple harmonic linear wave theory. For each model the basic differential equations are derived, numerical and computational methods of solution are described, and applicability is discussed. ESA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N78-30561*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A MICROWAVE PRESSURE SOUNDER
Dennis A. Flower and Gordon E. Peckham (Heriot-Watt Univ.) 1 Aug. 1978 143 p refs Sponsored in part by the UK Sci. Res. Council
(Contract NAS7-100)
(NASA-CR-157567; JPL-Pub-78-68) Avail: NTIS HC A07/MF A01 CSCL 14B

An instrument to measure atmospheric pressure at the earth's surface from an orbiting satellite would be a valuable addition to the expanding inventory of remote sensors. The subject of this report is such an instrument - the Microwave Pressure Sounder (MPS). It is shown that global-ocean coverage is attainable with sufficient accuracy, resolution and observational frequency for meteorological, oceanographic and climate research applications. Surface pressure can be deduced from a measurement of the absorption by an atmospheric column at a frequency in the wing of the oxygen band centered on 60 GHz. An active multifrequency instrument is needed to make this measurement with sufficient accuracy. The selection of optimum operating frequencies is based upon accepted models of surface reflection, oxygen, water vapor and cloud absorption. Numerical simulation using a range of real atmospheres defined by radiosonde observations were used to validate the frequency selection procedure. Analyses are presented of alternative system configurations that define the balance between accuracy and achievable resolution. Author

N78-30562# Los Alamos Scientific Lab., N. Mex.
NEUTRON RESPONSE OF A NEW ALBEDO-NEUTRON DOSIMETER
A. W. Blackstock, J. R. Cortez, G. J. Littlejohn, and E. Storm 1978 18 p Presented at 11th Symp. on Radiation Instrumentation San Diego, Calif., 17 Jan. 1978
(LA-UR-78-40; Conf-780110-8) Avail: NTIS HC A02/MF A01

The new dosimeter consists of a plastic badge holding an aluminum card which contains three LiF chips. In the albedo-neutron portion of the badge, based on Hankins' design, the TLD-600 and one TLD-700 chips are shielded from thermal neutrons by 0.026 inch- thick cadmium. From the difference in readings of these two TLD's, the neutron dose is estimated. The neutron energy response of the new badge was measured, and compared with a calculated response. A primary advantage of the TLD albedoneutron badge is its ability to record neutrons down to the cadmium cutoff. ERA

N78-30563# Bettis Atomic Power Lab., Pittsburgh, Pa.
BONDED RESISTANCE STRAIN GAGE APPLICATIONS
J. E. Mutter Mar. 1978 31 p
(Contract EY-76-C-11-0014)
(WARD-TM-1252) Avail: NTIS HC A03/MF A01

The practical experience and engineering techniques, in the past decade, assure data from bonded resistance strain gages are summarized. The underlying principles of strain gages are described, along with typical applications and the ever-present, and sometimes subtle, problems of temperature compensation, lead wire errors, gage factors, etc. Various hookup arrangements are explained, showing how strain gages can be used to determine bending, torque, tension, compression and shear forces. A general guide is provided on strain gage applications and to assist in overcoming some of the potential problems that arise in their use. ERA

N78-30564# California Univ., Livermore. Lawrence Livermore Lab.
EFFECT OF STRAIN-GAGE SURFACE PREPARATION TECHNIQUES ON BERYLLIUM
J. E. Hanafee, J. W. Hughes, Jr., and S. A. McInturff 19 Sep. 1977 7 p refs
(Contract W-7405-eng-48)
(UCID-17578) Avail: NTIS HC A02/MF A01

Beryllium is a metal sensitive to machining damage, causing a loss in mechanical properties. Since some mechanical abrading is often used in surface preparation for mounting strain gages, it is desirable to know whether the abrading produces flaws. Metallorgraphic study of beryllium subjected to four different surface preparation methods was carried out. It was determined that the gentle abrading necessary for affixing strain gages produced a negligible density and depth of flaws and did not lower the mechanical properties. ERA

N78-30565# National Bureau of Standards, Washington, D. C. National Engineering Lab.
CONTACT DEFORMATION IN GAGE BLOCK COMPARISONS
John S. Beers and James E. Taylor May 1978 49 p refs
(NBS-TN-962) Avail: NTIS HC A03/MF A01 CSCL 14B

When calibrating gage blocks or when gaging objects with contact type comparators, local deformation occurs where the probe tip contacts the gaging surface. This deformation results in a measurement error only if the gage blocks or objects being compared are of different materials having different mechanical properties. This document presents formulas and monographs for determining deformation magnitude, and instructions for appling deformation corrections. The formulas and monographs are valid only for spherical probe tips. A method is given for evaluating tip geometry and it is recommended that nonspherical or flawed tips be replaced. Author

N78-30566# National Technical Information Service, Springfield, Va.
HOLOGRAPHIC THEORY AND RECORDING TECHNIQUES. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1964 - May 1978
George W. Reimherr Jun. 1978 257 p Supersedes NTIS/PS-77/0534; NTIS/PS-76/0450; NTIS/PS-75/433; COM-74-10870

(NTIS/PS-78/0582/3; NTIS/PS-77/0534; NTIS/PS-76/0450; NTIS/PS-75/433; COM-74-10870) Avail: NTIS HC $28.00/MF $28.00 CSCL 14E

A bibliography containing 252 abstracts concerning holographic recording techniques, theory, equipment, and materials. Among the techniques cited are color holography, X-ray holography, high speed holography, and motion picture holography. Photographic materials, films, emulsions, and equipment for recording and information storage. Techniques for image motion compensation, image deblurring, wavefront reconstruction, and resolution were also cited. GRA

N78-30567# National Inst. for Occupational Safety and Health, Morgantown, W. Va. Testing and Certification Branch.

INDUSTRIAL SOUND LEVEL METER ENVIRONMENTAL TESTING

Robert J. Koshut Apr. 1978 35 p refs

(PB-280028/2; NIOSH/TC-P-015) Avail: NTIS HC A03/MF A01 CSCL 14B

This test procedure checks the effect on an industrial sound level meter when it is subjected to environmental conditions of temperature and humidity. Included is a list of equipment needed to perform the test and the configuration in which the equipment is to be used. GRA

N78-30355# California Univ., Livermore. Lawrence Livermore Lab.

A FLASH RADIOGRAPHIC TECHNIQUE APPLIED TO FUEL INJECTION SPRAYS

H. C. Vantine *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 336-337 (For primary document see N78-30332 21-31)

Avail: NTIS HC A23/MF A01

36 LASERS AND MASERS

Includes parametric amplifiers.

N78-30568 Texas Technological Univ., Lubbock.

LASER MODE ANALYSIS Ph.D. Thesis

Ajit Pal Singh Kwatra 1977 147 p

Avail: Univ. Microfilms Order No. 78-10841

A new integral equation for optical resonators was derived from the boundary value problem. This equation, called the Source Integral Equation (SIE) was solved approximately and mode shapes compared with those from the widely used Fox-Li Integral Equation (FLIE). A double resonance condition was obtained from a self-consistency condition. Approximations to the resonance condition was devised for the limiting case of flat mirrors. The results obtained from a Functional Equation Method (FEM) are compared with traditional computer solutions. The locations of the peaks and the valleys agree well and the overall mode shapes are similar. This verifies the utility of the FEM for spherical mirrors of circular aperture. The FLIE and SIE results from the FEM, are compared to confirm the validity of the FEM approach for the SIE. THe SIE results are compared to the traditional computer results to find effects of the corrections of the SIE and the FLIE. Dissert. Abstr.

N78-30569 Brigham Young Univ., Provo, Utah.

METHODS FOR IMPROVING EFFICIENCY OF DYE LASERS Ph.D. Thesis

Kenneth Lee Matheson 1978 179 p

Avail: Univ. Microfilms Order No. 7813804

Using solubility parameter theory, the solubility characteristics of several laser dyes were obtained to determine the solvents with the best thermooptical properties. The causes of internal heating were examined. Calculations indicate that modification of the pump band can decrease heating. Methods for modifiying the pumping radiation using UV absorbers and wavelength shifters are discussed, and spectroscopic data for some of these compounds are given. An emulsion dye laser is reported and two chemiluminescent reactions are evaluated as possible dye laser power sources. Finally, the possibility of using radicals as laser dyes to avoid the triplet problem is discussed. Dissert. Abstr.

N78-30570# GTE Labs., Inc., Waltham, Mass.

Nd MINI LASER BASED ON STOICHIOMETRIC RARE EARTHS COMPOUNDS Final Report, 25 Jun. 1975 - 24 Jun. 1977

A. Lempicki, E. Johnson, and B. McCollum Apr. 1978 154 p refs

(Contract DAAC29-75-C-0028)

(AD-A054434; ARO-13299.3-P) Avail: NTIS HC A08/MF A01 CSCL 20/5

This report contains an account of the principal results of an investigation into new stoichiometric compounds of Nd over a two-year period. The overall objective of this program was to develop new high concentration Nd materials for miniature lasers emitting at 1.06 micron. At the present time there are only a few such compounds, Nd pentaphosphate being the most widely known. Although remarkable in its efficiency, relative lack of concentration quenching and high gain, the growth of pentaphosphate crystals have proved to be difficult. The crystal growth problems of the pentaphosphate coupled with the possibilities for improved performance by new materials were motivating factors in the research. Author (GRA)

N78-30571# Aerospace Corp., El Segundo, Calif. Ivan A. Getting Labs.

SIMPLIFIED MODEL OF A CW DIFFUSION-TYPE CHEMICAL LASER: AN EXTENSION Interim Report

Harold Mirels Apr. 1978 59 p refs

(Contract F04701-77-C-0078)

(AD-A054616; TR-0078-(3940-01)-3; SAMSO-TR-78-83) Avail: NTIS HC A04/MF A01 CSCL 20/5

The simplified two-vibrational-level model of a cw diffusion-type chemical laser presented by Mirels, Hofland, and King is extended to include multiple vibrational levels. Both laminar and turbulent diffusion are considered. Expressions for axial gain distribution and net output power from a Fabry-Perot optical resonator are deduced. For a given lasing species, the resulting cw chemical laser scaling laws are the same as those previously deduced by Mirels, Hofland, and King, except for the dependence of certain coefficients on rotational quantum number J and temperature T. Broadwell previously presented a multiple-vibrational-level model for a cw chemical laser that was limited, however, to turbulent diffusion. The flame-sheet-mixing model used in the present study is shown to give results that are identical with those from the scheduled-mixing model of Broadwell when mean chemical rates are used. Author (GRA)

N78-30572# Army Inst. of Dental Research, Washington, D. C.

A NEW METHOD OF STERILIZATION: THE CARBON DIOXIDE LASER Technical Report, Jul. - Nov. 1977

James C. Adrian and Arthur Gross 8 May 1978 8 p refs

(AD-A054749) Avail: NTIS HC A02/MF A01 CSCL 13/8

The use of the Carbon Dioxide (CO_2) laser for sterilization of metal instruments was investigated. Scalpel blades contaminated with bacterial spores were exposed to the laser and subsequently cultured. Our results demonstrate that the CO_2 laser effectively sterilizes metal instruments. Author (GRA)

N78-30573# Aerospace Corp., El Segundo, Calif. Ivan A. Getting Labs.

SPIKE: A COMPUTER MODEL FOR THE H2(D2) + F2 PULSED CHEMICAL LASER Interim Report

Joseph J. T. Hough 14 Apr. 1978 78 p refs

(Contract F04701-77-C-0078)

(AD-A054929; TR-0078(3940-01)4; SAMSO-TR-78-84) Avail: NTIS HC A05/MF A01 CSCL 20/5

A comprehensive rate equation model for a pulsed laser pumped by the H2(D2)-F2 reaction is described. This computer simulation incorporates up to 216 kinetic reactions to describe the laser medium, which is assumed to be homogeneous and contained in a Fabry-Perot optical cavity. The first fifteen vibrational-rotational P-branch transitions from each of the lowest ten vibrational bands are monitored for possible laser action. The distinctive features incorporated in this model include: (1) the elimination of the gain-equals-loss assumption, so that it is possible to predict cavity transients and to observe gain-intensity interactions; (2) a detailed model of the Lorentz broadening, including V,J dependence, as well as distinction

between various perturbing species; (3) multiquantum HF (DF) self-deactivation, which in the HF case was found important to achieve good agreement between theory and experiment. Comparisons of the prediction of this model with several small-scale experiments have indicated generally good agreement (typically within approx. 20%). Author (GRA)

N78-30574# Owens-Illinois, Inc., Toledo, Ohio.
DEVELOPMENT OF IMPROVED LASER GLASSES WHICH CAN BE MELTED ON A COMMERCIAL SCALE Quarterly Progress Report, 1 Jan. - 31 Mar. 1977
C. F. Rapp and P. J. Vergano 1977 32 p
(Contract EY-76-C-02-4080)
(COO-4080-3; QPR-2) Avail: NTIS HC A03/MF A01

Progress is reported in the development of low n sub 2 fluorophosphate laser glasses. Achievements include: (1) the completion of construction of the fluoride melting furnace; (2) the identification of the alkaline earth fluoride-AlF3-Al(PO3)3 system as being that which shows the most promise for producing glasses which meet the program objectives; and (3) the production of several glasses which meet or nearly meet the program's objectives. ERA

N78-30575# GTE Labs., Inc., Waltham, Mass.
FLUORESCENCE LINE-NARROWING STUDIES OF Nd: GLASS LASER MATERIALS
L. A. Riseberg and C. Brecher Feb. 1978 37 p refs
(Contract W-7405-eng-48)
(UCRL-13823) Avail: NTIS HC A03/MF A01

From a detailed study of Nd (3+) in five different glassy hosts, it was found that even in the absence of specific spectral detail the excitation-dependent patterns of quantum efficiency and radiative and nonradiative transition rates can be powerful tools in characterizing the glass medium. In fluorophosphate glass, these measurements led to the first experimental evidence for the existence of chemically distinct coordinating species in a mixed anion glass. ERA

N78-30576# California Univ., Livermore. Lawrence Livermore Lab.
AUTOMATED LASER FUSION TARGET PRODUCTION CONCEPT
C. D. Hendricks 4 Oct. 1977 5 p refs Presented at Topical Meeting on Inertial Confinement Fusion, San Diego, Calif., 7-9 Feb. 1978
(Contract W-7405-eng-48)
(UCRL-80209; Conf-780202-16) Avail: NTIS HC A02/MF A01

A target production concept is described for the production of multilayered cryogenic spherical inertial confinement fusion targets. The facility is to deliver targets to the reactor chamber at rates up to 10 per second and at costs consistent with economic production of power. ERA

N78-30577# Los Alamos Scientific Lab., N. Mex.
DOUBLE-SHELL TARGET DESIGNS FOR THE LOS ALAMOS SCIENTIFIC LABORATORY EIGHT-BEAM LASER SYSTEM
Joseph M. Kindel and Michael A. Stroscio Mar. 1978 15 p refs
(Contract W-7405-eng-36)
(LA-7167-MS) Avail: NTIS HC A02/MF A01

Two double-pusher laser fusion targets are investigated, one that incorporates an outer exploding pusher shell and another that uses velocity multiplication. Specific designs are presented for the Los Alamos Scientific Laboratory Eight-Beam Laser System. ERA

N78-30578# California Univ., Livermore. Lawrence Livermore Lab.
DESIGN STUDIES OF A LASER FUSION POWER PLANT
J. A. Maniscalco, W. R. Meier, and M. J. Monsler 7 Oct. 1977 21 p refs Presented at IAEA Conf. and Workshop on Fusion Reactor Design, Madison, Wis., 12 Oct. 1977
(Contract W-7405-eng-48)
(UCRL-80081; Conf-771056-11) Avail: NTIS HC A02/MF A01

The conceptual design of a laser fusion power plant was undertaken to exploit recent developments in target design. Advanced high-gain targets which were developed, make it possible to significantly relax the laser and optical system requirements. The power plant design features a reactor concept which utilizes a thick falling region of liquid lithium to protect the first-wall from the neutrons, X-rays, and charged particles that are produced in the thermonuclear microexplosion. The lithium waterfall has also been designed to be thick enough to significantly reduce the effects of 14 MeV neutrons and cyclical stresses on the blanket structure; thereby allowing us to consider smaller blanket structures which could last the lifetime of the plant. Fusion targets producing 700 MJ of thermonuclear energy are ignited by a 2 percent efficient, 1 MJ laser system at the rate of 1.4 Hz. Schemes for protecting the final focusing optics are described which are both compatible with this reactor system, and show promise of surviving a full year in order to minimize costly downtime. ERA

N78-30579# California Univ., Livermore. Lawrence Livermore Lab.
REQUIREMENTS AND NEW MATERIALS FOR FUSION LASER SYSTEMS
S. E. Stokowski, M. J. Weber, R. A. Saroyan, and W. F. Hagen Oct. 1977 11 p Presented at Electro-Optical Systems Conf., Anaheim, Calif., 25 Oct. 1977
(Contract W-7405-eng-48)
(UCRL-80210; Conf-771040-11) Avail: NTIS HC A02/MF A01

Higher focusable power in neodymium glass fusion lasers can be obtained through the use of new materials with lower nonlinear index (n2) and better energy storage capabilities than the presently employed silicate glass. Silicate, phosphate, fluorophosphate, and beryllium fluoride glasses are discussed in terms of fusion laser requirements, particularly those for the proposed Nova laser. Examples of the variation in spectroscopic and optical properties obtainable with compositional changes are given. Results of a system evaluation of potential laser materials show that fluorophosphate glasses have many of the desired properties for use in Nova. These glasses are now being cast in large sizes (30 cm diameter) and will be tested in prototype amplifiers in 1978. ERA

N78-30580# Technische Physische Dienst TNO-TH, Delft (Netherlands). Afd. Optics.
THE APPLICATION OF BACKSCATTER LASER DOPPLER TECHNIQUES FOR VELOCITY MEASUREMENTS AT VESSELS AND SHIP MODELS
J. Oldengarm and A. H. vanKrieken 13 Apr. 1977 56 p refs
(Contract A76/KM/016)
(TPD-1977-0-1; TDCK-69385) Avail: NTIS HC A04/MF A01

Various arrangements are discussed for backscatter laser velocimeters to be used for velocity measurements in the wake field of ship models. Laboratory experiments show that a fringe mode laser Doppler arrangement that employs the photon correlation technique gives the best results when operating with low power lasers. An experimental (coaxial) optical system using a 5 mW He-Ne laser is described. Results are reported for velocity measurements in the wake field of a ship model as carried out at the Netherlands Ship Model Basin at Wageningen. The experiments show that the photon correlation technique is suited for ship model work when using a coaxial optical system that transmits the laser beams and collects the backscattered light. Several suggestions for improvement are made to reduce the time of measurement. The use of a 50 mW argon laser when employing photon correlation is proposed, and it is expected that a laser power of at least 1 W is required for operation with a conventional laser Doppler signal processor, such as a frequency tracker. Finally, the use of the laser Doppler technique is discussed for full scale measuremenrs on in-voyage vessels at sea. A laser Doppler system capable of measuring velocities at a range of 10 m is proposed. Author (ESA)

N78-30581# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.
LASER INDUCED DAMAGE IN OPTICAL MATERIALS, 1977. PROCEEDINGS OF 9TH ANNUAL SYMPOSIUM ON OPTICAL MATERIALS FOR HIGH POWER LASERS Final Report
Alexander J. Glass, ed. (Calif. Univ., LLL) and Arthur H. Guenther,

ed. (AFWL, Kirtland AFB, N. M.) Dec. 1977 561 p refs Symp. held at Boulder, Colo., 4-6 Oct. 1977; sponsored by NBS, Am. Soc. for Testing and Mater., ONR, DoE, and DARPA (PB-279938/5; NBS-SP-509) Avail: NTIS HC A24/MF A01 CSCL 20E

The symposium was divided into sessions concerning laser windows and materials, mirrors and surfaces, thin films, laser glass and glass lasers, and fundamental mechanisms. Particular emphasis was given to materials for use from 10.6 micrometer to the UV region. Highlights included surface characterization, thin film-substrate boundaries, and advances in fundamental laser-matter threshold interactions and mechanisms. The scaling of damage thresholds with pulse duration, focal area, and wavelength is also discussed. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N78-30582*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

APOLLO TELESCOPE MOUNT: A PARTIAL LISTING OF SCIENTIFIC PUBLICATIONS, SUPPLEMENT 2

John M. Reynolds, ed. and William C. Snoddy, ed. Aug. 1978 46 p refs

(NASA-TM-78183) Avail: NTIS HC A03/MF A01 CSCL 13I

Reports are compilations of bibliographies from the principal investigator groups of the Apollo Telescope Mount (Skylab solar observatory facility) that gathered data from May 28, 1973, to February 8, 1974. The analysis of these data is presently under way and is expected to continue for several years. The publications listed in this report are divided into the following categories: (1) Journal Publications, (2) Journal Publications Submitted, (3) Other Publications, (4) Presentations--National and International Meetings, and (5) Other Presentations. An author index is included together with errata for the first report. G.Y.

N78-30583*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

ANALYSIS OF A SUSPENSION SYSTEM FOR A WHEEL ROLLING ON A FLAT TRACK

H. McGinness 1 Aug. 1978 24 p ref

(Contract NAS7-100)

(NASA-CR-157563; JPL-Pub-78-43) Avail: NTIS HC A02/MF A01 CSCL 13I

A flexure strut wheel suspension system is described which keeps a wheel flat against the track and maintains a small interface moment. Equations are presented for the evaluation of this moment. A comparison of the flexure strut system is made with a rigid link design containing pivot bearings. Author

N78-30584*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

LIQUID ROCKET ENGINE TURBOPUMP ROTATING-SHAFT SEALS NASA Space Vehicle Design Criteria, Chemical Propulsion

R. E. Burcham and Russell B. Keller, Jr., ed. Feb. 1978 160 p refs Prepared in cooperation with Rocketdyne, Canoga Park, Calif.

(NASA-SP-8121) Avail: NTIS HC A08/MF A01 CSCL 11A

A monograph is organized and presents, for effective use in design, the significant experience and knowledge accumulated in development and operational programs to date. It reviews and assesses current practices, and from them establishes firm guidance for achieving greater consistency in design, increased reliability in the end product, and greater efficiency in the design effort. The monograph is divided into two major sections: state of the art and design criteria. G.Y.

N78-30585*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF GEOMETRY ON HYDRODYNAMIC FILM THICKNESS

David E. Brewe (AVRADCOM Res. and Technol. Labs.), Bernard J. Hamrock, and Christopher M. Taylor (Leeds Univ., England) Aug. 1978 36 p refs Proposed for presentation at ASLE-ASME Joint Lubrication Conf., Minneapolis, 24-26 Oct. 1978

(NASA-TP-1287; E-9347; AVRADCOM-TR-78-18) Avail: NTIS HC A03/MF A01 CSCL 20K

The influence of geometry on the isothermal hydrodynamic film separating two rigid solids was investigated. Pressure-viscosity effects were not considered. The minimum film thickness is derived for fully flooded conjunctions by using the Reynolds conditions. It was found that the minimum film thickness had the same speed, viscosity, and load dependence as Kapitza's classical solution. However, the incorporation of Reynolds boundary conditions resulted in an additional geometry effect. Solutions using the parabolic film approximation are compared with those using the exact expression for the film in the analysis. Contour plots are shown that indicate in detail the pressure developed between the solids. Author

N78-30586# Suntech, Inc., Marcus Hook, Pa.

INFRARED SPECTRA OF FLUID FILMS UNDER CONDITIONS OF INCIPIENT BEARING FAILURE Final Report

James L. Lauer 22 Dec. 1977 112 p refs Supersedes report dated 20 Dec. 1977

(Contracts F49620-76-C-0042; F44620-74-C-0038)

(AD-A054290; AFOSR-78-0190TR) Avail: NTIS HC A06/MF A01 CSCL 11/8

Emission Spectra were obtained from our operating E.H.D. contacts through a diamond window, using a specially built Fourier Infrared Emission Microinterferometer. These spectra were compared with similar static spectra obtained in a high-pressure diamond anvil cell. As an example, 5P4E, polyphenyl ether fluid is discussed in detail. Changes in the spectrum with pressure and temperature under static conditions allow inferences on these parameters under various dynamic conditions. The dynamic spectra differ markedly under polarization, an indication of molecular alignment. Author (GRA)

N78-30587# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.

STATIC AND DYNAMIC ANALYSIS OF CAST AND CAST CARCASS TIRES Final Report, Mar. 1974 - Dec. 1975

James R. Hampton Mar. 1978 93 p refs

(AD-A054941; AFFDL-TR-78-42) Avail: NTIS HC A05/MF A01 CSCL 01/3

The AFFDL/FEM initiated a program with Zedron, Inc., to establish the potential of cast tires for application to Air Force aircraft. This program involved the analysis of seventy-five (75) cast 6.00-6 Type III aircraft tires which were rotationally cast/molded from a thermoplastic polyester elastomer material (Hytrel). These tires have a continuous toroidal construction and do not have textile reinforcement or bead bundles. The first of a two phase program involved static and dynamic analysis of off-the-shelf light industrial vehicle cast tires which had a rated maximum loading of 415 lbs and rated maximum speed of 10 mph. The second phase of this In-house test program resulted in a 6.00-6 size cast tire which satisfactorily passed 89 laboratory dynamometer qualification taxi takeoff cycles. Each of these test cycles consisted of a one mile taxi under a 1150 lb load at 30 mph followed by a simulated takeoff starting at 0 mph with lift off at 90 mph. The dramatic improvement of cast tire capability demonstrated by these tests established feasibility of cast and cast carcass tires, and also provided the basis for a contract, 'Development of Cast Carcass Tires for Military Aircraft', AFFDL Work Unit 13690147. Author (GRA)

N78-30588# Syracuse Univ., N. Y. Dept. of Mechanical and Aerospace Engineering.

IMPACT STRESSES IN FLAT-PACK LIDS AND BASES Final Report

Charles Libove Apr. 1978 47 p refs

(Contract F30602-75-C-0121)

(AD-A054947; MAE-1229-T-1; RADC-TR-78-98) Avail: NTIS HC A03/MF A01 CSCL 13/4

An analysis is made of the normal handling that a microelectronic package is likely to encounter. The stresses and deformations of the lids and bases of a rectangular flat-pack caused by the accidental dropping of the package onto a floor from a height of a few feet, are assessed theoretically. The results of the study shows that the assumed normal handling conditions constitutes a severe environment which is capable of producing

stress that will buckle a metallic lid or crack a ceramic lid or base. Author (GRA)

N78-30589# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering and Applied Mathematics.
EROSION STUDY IN TURBOMACHINERY AFFECTED BY COAL AND ASH PARTICLES. PHASE 1: TECHNICAL REPORT
W. Tabakoff, R. Kotwal, and A. Hamed Apr. 1978 11 p refs Presented at the 23d Gas Turbine Conf. and Prod. Show, London, 9-13 Apr. 1978
(Contract EX-76-C-01-2465)
(FE-2465-6) Avail: NTIS HC A02/MF A01

The aerodynamic effect of the flow field can be a very important factor in turbomachine erosion, where the flow is constantly turned by rotating and stationary cascades. Two erosion test facilities were built. Wind tunnel with a stationary specimen was designed to obtain basic erosion data, particle impact, and rebound characteristics. Another test facility, was then designed to simulate and measure the erosion of turbomachine blades. With the basic information developed in this test facility and the empirical relations derived therefrom, the necessary data are available to calculate the material removed by erosion. This, together with an analysis of particle trajectories in turbomachines, can be used in the prediction of erosion of the different turbine components by the ash particles. ERA

N78-30590# Energy Research and Development Administration, Bartlesville, Okla.
INVESTIGATION OF FUEL ECONOMY POTENTIAL OF FOUR 1977 MODEL VEHICLES
R. L. Bechtold and R. D. Fleming 1977 10 p refs Presented at Passenger Car Meeting, Detroit, 26-30 Sep. 1977; sponsored by SAE
(CONF-7709103-1) Avail: NTIS HC A02/MF A01

A vehicle testing program was conducted to determine the inherent fuel economy potential of current (1977) technology engines given freedom to opimize engine adjustment for best fuel economy with no constraint on engine-out emissions. The average city/highway fuel economy of four car models with optimized air-fuel ratio and spark timing was improved by 4.1% as compared to the fuel economy of the baseline values found for the vehicles with air-fuel ratio and spark timing at manufacturer's specifications. ERA

N78-30591# California Univ., Livermore. Lawrence Livermore Lab.
ELECTRON BEAM CAVITY TEMPERATURE DISTRIBUTIONS IN PURE METALS AND ALLOYS
D. A. Schauer, W. H. Giedt, and S. M. Shintaku 1 Feb. 1978 29 p refs Presented at the 59th AWS Ann. Meeting, New Orleans, 3-7 Apr. 1978
(Contract W-7405-eng-48)
(UCRL-80723) Avail: NTIS HC A03/MF A01

The adaption of a narrow band infrared radiation pyrometer for measurements of the surface temperature variation in an electron beam welding cavity is described. Results are presented for welds in aluminum 1100, 2024, 5083, 6061, and 7075; steel 304, 20-6-9, and HY-180, and tantalum. Average peak temperatures for aluminum decreased from a maximum of 1900 C for the 1100 alloy to 1250 C for the 5083 alloy and 1080 C for the 7075 alloy; for steel 304, 20-6-9 and HY-180 peak values were 2100, 1820, and 2290 C. This change was shown to be due to the presence of relatively volatile constituents in the alloys. It was also found that for a specific material the peak temperature did not vary significantly with penetration depth. ERA

N78-30592# California Univ., Livermore. Lawrence Livermore Lab.
PREDICTION OF ELECTRON BEAM WELDING SPIKING TENDENCY
D. A. Schauer and W. H. Geidt 1 Feb. 1978 33 p refs Presented at 59th AWS Ann. Meeting, New Orleans, 3-7 Apr. 1978
(Contract W-7405-eng-48)
(UCRL-80724; Conf-780406-2) Avail: NTIS HC A03/MF A01

On the basis of measured temperature distributions in electron beam welding cavities it is shown that the vapor pressure force dominates in the lower region and the surface tension in the upper region. The region where these two forces are approximately equal is unstable and the surface tension force causes inward flow of liquid metal which tends to form a projection. For a specific material this projection location was found to depend on cavity depth. By postulating that the formation of liquid metal projections at this location results in cavity instabilities, a physical model for predicting when spiking would occur was proposed. A procedure then developed for determining the spiking tendency for a specified material and set of weld parameters is described. ERA

N78-30593# California Univ., Livermore. Lawrence Livermore Lab.
THERMAL AND DYNAMIC EFFECTS IN ELECTRON BEAM WELDING CAVITIES Ph.D. Thesis
Dale A. Schauer Aug. 1977 177 p refs
(Contract W-7405-eng-48)
(UCRL-52331) Avail: NTIS HC A09/MF A01

Temperature distributions along the molten metal surface in an electron beam welding cavity were measured with a narrow band infrared radiation pyrometer. Estimates made for the vapor pressure and surface energy forces as a function of cavity position indicate a force imbalance in the cavity, where, it is postulated, a liquid material projection forms periodically and moves into the path of the electron beam. The liquid in this projection is driven towards the bottom, partially filling the cavity. This action is followed by the electron beam pushing the liquid aside to form a maximum depth cavity. A study of the measured temperature distributions in cavities of varying depth combined with the force imbalance observations led to an interpretation of when spiking might occur. A procedure is proposed for determining the spiking tendency for a given set of weld parameters. ERA

N78-30594# Atomics International, Canoga Park, Calif.
WATER TESTING OF THE INDUCER PUMP
C. Dunn and R. K. Hoshide Sep. 1977 100 p refs
(Contract EY-76-C-03-0824-024)
(AI-ERDA-13207) Avail: NTIS HC A05/MF A01

The inducer pump, designed and fabricated as a test article to evaluate the inducer/impeller pump concept for providing improved suction performance of large sodium pumps, was tested. The inducer stage in front of the centrifugal impeller dramatically reduces the size of pumps. It was demonstrated that the inducer can operate at suction specific speeds in excess of 35,000, whereas conventional centrifugal pumps have demonstrated capability to only 12,000. The inducer pump employs several components of the 2000 and 4000 gpm NaK pumps. Use of the volute, thermal barrier and shaft oil seal from the CANEL pumps allowed acceleration and cost reduction of the inducer pump program. ERA

N78-30595*# National Academy of Sciences - National Research Council, Washington, D. C. Federal Construction Council.
STATIONARY DIESEL ENGINES FOR USE WITH GENERATORS TO SUPPLY ELECTRIC POWER
1977 37 p
(Contracts NASw-2988; EA-77-C-01-2641; N00025-77-C-0001; GS-00-B-871)
(PB-280112/4; TR-69) Avail: NTIS HC A03/MF A01 CSCL 21G

The procurement of stationary diesel engines for on-site generation of electric power deals with technical criteria and policy relating to federal agency, not electrical components of diesel-generator sets or for the design of electric-power generating plants or their air-pollution or noise control equipment. GRA

N78-30294*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
REVIEW OF JPL AUTOMOTIVE TECHNOLOGY STATUS AND PROJECTIONS (ATSP) PROJECT
Mack W. Dowdy *In* DOE Highway Vehicle Systems Mar. 1978 p 17-27 ref (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

N78-30295*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VEEP: A VEHICLE ECONOMY, EMISSIONS, AND PERFORMANCE SIMULATION PROGRAM
Gerhard J. Klose *In* DOE Highway Vehicle Systems Mar. 1978 p 28-31 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

N78-30296# Postal Service, Washington, D. C.
USPS LIGHT DELIVERY VEHICLES PROGRAM
Wilson E. Hull *In* DOE Highway Vehicle Systems Mar. 1978 p 31-39 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

N78-30297# Borg-Warner Corp., Chicago, Ill. Morse Chain Div.
DOE/GSA MICROFLEET EVALUATION OF THE MORSE CONTROL SPEED ACCESSORY DRIVE
C. Wollard *In* DOE Highway Vehicle Systems Mar. 1978 p 40-51 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

N78-30298# Thermo Electron Corp., Waltham, Mass.
ORGANIC RANKINE BOTTOMING CYCLE FOR LONG HAUL DIESEL TRUCKS
Robert Raymond *In* DOE Highway Vehicle Systems Mar. 1978 p 52-67 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

N78-30299# Sandia Labs., Albuquerque, N. Mex.
SUMMARY OF VARIABLE DISPLACEMENT ENGINE PROJECT
C. W. Robinson *In* DOE Highway Vehicle Systems Mar. 1978 p 67-73 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

N78-30300# Orshansky Transmission Corp., New York.
HYDRO-MECHANICAL TRANSMISSION DEVELOPMENT FOR PASSENGER CAR FUEL ECONOMY
Peter Huntley *In* DOE Highway Vehicle Systems Mar. 1978 p 73-93 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

N78-30301# Mechanical Technology, Inc., Latham, N. Y.
DEMONSTRATION OF HYDRAULIC MODULE FOR AN AUTOMOTIVE HYDROMECHANICAL TRANSMISSION
Paul Lewis *In* DOE Highway Vehicle Systems Mar. 1978 p 94-101 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

N78-30302# AiResearch Mfg. Co., Phoenix, Ariz.
IMPROVING AUTOMOBILE FUEL ECONOMY WITH ACCESSORY DRIVES
C. H. Lefferts *In* DOE Highway Vehicle Systems Mar. 1978 p 101-124 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

N78-30303*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GAS TURBINE PROJECT STATUS
W. E. Goette *In* DOE Highway Vehicle Systems Mar. 1978 p 125-129 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01 CSCL 21A

N78-30304# Chrysler Corp., Detroit, Mich.
STATUS OF THE CHRYSLER UPGRADED GAS TURBINE ENGINE PROGRAM
C. E. Wagner *In* DOE Highway Vehicle Systems Mar. 1978 p 129-142 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

N78-30305*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LEWIS RESEARCH CENTER SUPPORT OF CHRYSLER UPGRADED ENGINE PROGRAM
E. L. Warren *In* DOE Highway Vehicle Systems Mar. 1978 p 143-149 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01 CSCL 21A

N78-30306# General Motors Corp., Detroit, Mich.
IMPROVED HEAVY DUTY GAS TURBINE ENGINE PROGRAM
H. E. Helms and Franklin A. Rockwood *In* DOE Highway Vehicle Systems Mar. 1978 p 149-164 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

N78-30307# Ford Motor Co., Dearborn, Mich.
STATUS OF FORD REGENERATOR SYSTEMS DEVELOPMENT
C. S. Rahnke *In* DOE Highway Vehicle Systems Mar. 1978 p 165-174 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

N78-30308# Mechanical Technology, Inc., Latham, N. Y.
DEVELOPMENT OF COMPLIANT FOIL BEARINGS FOR AUTOMOTIVE GAS TURBINES
Stanley Gray *In* DOE Highway Vehicle Systems Mar. 1978 p 174-194 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

N78-30309# Ford Motor Co., Dearborn, Mich.
FABRICATION AND TESTING OF SILICON NITRIDE TURBINE ROTORS
D. L. Harstock *In* DOE Highway Vehicle Systems Mar. 1978 p 194-208 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

N78-30314*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STIRLING ENGINE PROJECT STATUS
R. G. Ragsdale *In* DOE Highway Vehicle Systems Mar. 1978 p 241-243 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01 CSCL 21A

N78-30315# Ford Motor Co., Dearborn, Mich.
IMPROVED STIRLING ENGINE DEVELOPMENT
Norman D. Postma *In* DOE Highway Vehicle Systems Mar. 1978 p 243-254 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

N78-30316*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INITIAL TEST RESULTS WITH SINGLE CYLINDER RHOMBIC DRIVE STIRLING ENGINE
James E. Cairelli *In* DOE Highway Vehicle Systems Mar. 1978 p 254-258 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01 CSCL 13I

N78-30317# Boeing Commercial Airplane Co., Seattle, Wash.
EVALUATION OF RECIPROCATING SEALS FOR STIRLING CYCLE ENGINE APPLICATION
Al W. Waterman *In* DOE Highway Vehicle Systems Mar. 1978 p 258-266 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

N78-30318*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MATERIALS TECHNOLOGY ASSESSMENT FOR STIRLING ENGINES
Joseph R. Stephens *In* DOE Highway Vehicle Systems Mar. 1978 p 267-274 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01 CSCL 21A

N78-30319# Washington Univ., Seattle.
SURVEY OF STIRLING ENGINE ANALYTICAL DESIGN METHODS
W. R. Martin *In* DOE Highway Vehicle Systems Mar 1978 p 274-286 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

N78-30320# Mechanical Technology, Inc., Latham, N. Y.
THERMAL ENERGY STORAGE/HEAT ENGINE FOR HIGHWAY VEHICLE PROPULSION
L. R. Folsom *In* DOE Highway Vehicle Systems Mar. 1978 p 286-303 refs (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

N78-30324# Miami Univ., Fla.
DATA FOR DESIGN OF A HYDROGEN ENGINE: A PROGRESS REPORT
Robert R. Adt, Jr. and Michael R. Swain *In* DOE Highway Vehicle Systems Mar. 1978 p 341-350 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

N78-30329# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Labs.
ENGINE LUBRICANTS FOR USE IN METHANOL FUELED HIGHWAY VEHICLES
E. C. Owens *In* DOE Highway Vehicle Systems Mar. 1978 p 377-385 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

N78-30330# Michigan Univ., Ann Arbor.
SOLVING ALCOHOL FUEL PROBLEMS BY ENGINE MODIFICATION
D. J. Patterson *In* DOE Highway Vehicle Systems Mar. 1978 p 385-397 (For primary document see N78-30293 21-31)
Avail: NTIS HC A20/MF A01

N78-30333*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CATALYTIC COMBUSTION FOR THE AUTOMOTIVE GAS TURBINE ENGINE
D. N. Anderson *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 47-54 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01 CSCL 21A

N78-30334# Chrysler Corp., Detroit, Mich.
THE ERDA/CHRYSLER UPGRADED AUTOMOTIVE GAS TURBINE ENGINE-EMISSION CONTROL SYSTEM
T. D. Nogle *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 54-63 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

N78-30335# Volkswagen A.G., Wolfsburg (West Germany).
THE AUTOMOTIVE GAS TURBINE: STATE OF DEVELOPMENT AND PROSPECTS
P. Walzer *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 63-76 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

N78-30336# Nissan Motor Co. Ltd., Tokyo (Japan).
COMBUSTION PERFORMANCE OF INTERMITTENT FUEL INJECTION FOR A GAS TURBINE
N. Handa *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 77-94 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

N78-30337# United Turbine A.B., Malmo (Sweden).
THREE-SHAFT TURBINE-TRANSMISSION SYSTEMS FOR VEHICULAR APPLICATIONS
S. O. Kronogard *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 94-115 ref (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

N78-30338# Ford Motor Co., Dearborn, Mich.
CERAMIC GAS TURBINE TECHNOLOGY MATERIALS FOR TURBINE ROTORS
A. F. McLean, L. R. Swank, and J. C. Uy *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 115-127 refs (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

N78-30339# Booz-Allen Applied Research, Inc., Chicago, Ill.
GAS TURBINE ENGINE APPLICATIONS IN TRANSIT COACHES
H. Backel *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 127-136 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

N78-30340# Detroit Diesel Allison, Indianapolis, Ind.
IMPROVED HEAVY DUTY GAS TURBINE ENGINE
H. E. Helms *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 136-164 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

N78-30342# Pratt and Whitney Aircraft, West Palm Beach, Fla. Government Products Div.
NETSHAPE INTEGRAL AND CERAMIC BLADED WROUGHT SUPERALLOY GAS TURBINE ROTORS
B. H. Walker *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 180-193 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

N78-30343# Mechanical Technology, Inc., Latham, N. Y.
COMPLAINT FOIL AIR BEARINGS FOR HIGH PERFORMANCE AUTOMOTIVE GAS TURBINE
S. Gray *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 193-220 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

N78-30344# Ford Motor Co., Dearborn, Mich.
CERAMIC REGENERATOR CORE DESIGN AND RELIABILITY
C. J. Rahnke *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 220-235 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

N78-30346# United Stirling A.B., Eskilstuna (Sweden).
THE DEVELOPMENT OF 40-150 kw STIRLING ENGINES IN SWEDEN AND THEIR APPLICATION IN MINING EQUIPMENT, TOTAL ENERGY SYSTEMS AND ROAD VEHICLES
B. Hallare *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 248-268 refs (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

N78-30347# D-Cycle Power Systems, Inc., Richmond, Va.
D-CYCLE VAPOR STIRLING ENGINE
J. G. Davoud *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 268-279 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

N78-30348# Ford Motor Co., Dearborn, Mich.
STIRLING ENGINE PROGRAM
E. Kitzner *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 279-291 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

N78-30349# Renner (R. A.), Livermore, Calif.
AUTOMOTIVE RANKINE ENGINE DEVELOPMENT
R. A. Renner *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 291-297 ref (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

N78-30350# Jay - Carter Enterprises, Inc., Burkburnett, Tex.
DESCRIPTION AND TEST RESULTS OF THIRD GENERATION CARTER STEAM SYSTEM AS INSTALLED IN A VW DASHER
J. W. Carter, Jr. *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 297-301 refs (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

N78-30351# Thermo Electron Corp., Waltham, Mass.
STATUS REPORT ON AN ORGANIC RANKINE BOTTOMING CYCLE FOR LONG-HAUL DIESEL TRUCKS

R. J. Raymond *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 301-316 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

N78-30352# Ricardo & Co., Engineers (1927) Ltd., Shoreham-by-Sea (England).
THE DIESEL IS THE ENGINE FOR HIGH ANNUAL MILEAGE, LIGHT DUTY VEHICLES
C. C. J. French *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 317-318 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

N78-30353# Fiat Research Center, Turin, Italy.
GASEOUS EMISSIONS CONTROL FOR HEAVY DUTY DIESEL ENGINES
C. Lombardi *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 319-329 refs (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

N78-30354# Perkins Engine Co., Peterboro (England).
TURBOCHARGING THE SQUISH LIP LOW POLLUTION DIESEL ENGINE
C. Goodwin *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 329-336 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

N78-30356# Teledyne Continental Motors, Muskegon, Mich.
AN ADVANCED LOW EMISSION DIESEL ENGINE CONCEPT
S. H. Hill *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 337-346 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

N78-30357# Cummins Engine Co., Inc., Columbus, Ind.
DIESEL ENGINE AND CONSERVATION
R. Kamo *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 346-362 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

N78-30358# Volkswagen A.G., Wolfsburg (West Germany).
DESIGN AND LAYOUT OF ENERGY EFFICIENT AND LOW POLLUTING DIESEL ENGINES FOR CAR APPLICATION
B. Wiedermann *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 362-378 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

N78-30359# Volkswagen A.G., Wolfsburg (West Germany).
DEVELOPMENT STATUS OF THE VOLKSWAGEN STRATIFIED CHARGE ENGINE
W. Brandstetter *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 378-386 refs (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

N78-30360# British Leyland Motor Corp., Ltd., London (England).
BRITISH LEYLAND EXPERIMENTAL STRATIFIED CHARGE ENGINE
J. H. Weaving *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 387-407 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

N78-30361# Le Moteur Moderne, Boulogne (France).
TWO-CYCLE STRATIFIED CHARGE ENGINE
J. Prichard *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 407-425 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

N78-30362# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
MODELING AND EVALUATION OF COMBUSTION PROCESS OF A THREE-VALVE STRATIFIED CHARGE ENGINE
M. K. G. Babu and S. Yagi (Honda Research and Development Co., Japan) *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 426-432 (For primary document see N78-30332 21-31)
Avail: NTIS HC A03/MF A01

N78-30363# Fuel Injection Development Corp., Belmar, N. J.
A RETROFIT FUEL VAPOR METERING SYSTEM WITH TORCH IGNITION AND MULTIFUEL CAPACITY
E. Leshner *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 432-442 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

N78-30364# Curtiss-Wright Corp., Wood-Ridge, N.J.
AN UPDATE OF THE DIRECT INJECTED STRATIFIED CHARGE ROTARY ENGINE DEVELOPMENTS AT CURTISS-WRIGHT
C. Jones *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 443-460 refs (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

N78-30365# Naval Academy, Annapolis, Md.
NAVAL ACADEMY HEAT BALANCED ENGINE (NAHBE)
A. A. Pouring *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 461-479 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

N78-30366# Porsche (Ferdinand) AG, Stuttgart (West Germany).
OPERATING WITH LEAN MIXTURES: A SOLUTION FOR THE FUTURE?
R. Hahn *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 480-487 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

N78-30367# Siemens A.G., Erlangen (West Germany). Research Labs.
DEVELOPMENT OF A COMPACT GAS GENERATOR FOR FUEL GASIFICATION ABOARD A MOTOR VEHICLE
A. Michel *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 488-501 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

N78-30368# Stanford Univ., Calif.
CLOSED LOOP CONTROL OF SPARK ADVANCES
J. D. Powell *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 P 503-510 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

N78-30369# Harker Industries, Inc., Annandale, Va.
A NEW LOOK AT EXHAUST GAS RECYCLE AND ITS POTENTIAL FOR IMPROVING FUEL FLEXIBILITY AND ECONOMY OF SPARK IGNITION ENGINES
A. Lowi *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 1 Feb. 1978 p 510-515 (For primary document see N78-30332 21-31)
Avail: NTIS HC A23/MF A01

N78-30379# Fiat Research Center, Turin, Italy.
OPTIMIZING THE ENGINE-TRANSMISSION SYSTEM BY MEANS OF AN ELECTRONICALLY CONTROLLED GEARBOX
L. Marello *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 610-627 refs (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30380# Ultra Electronics, Ltd., London (England).
PROGRAMMABLE CONTROLS: A CONTROL ENGINEER'S DREAM
A. N. Thatcher *In* NATO Proc. of the 4th Intern. Symp. on

Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 627-647 ref (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30381# General Motors Technical Center, Warren, Mich.
AN ANALYTICAL STUDY OF TRANSMISSION MODIFICATIONS AS RELATED TO VEHICLE PERFORMANCE
H. E. Chana *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 647-650 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30382# Little (Arthur D.), Inc., Cambridge, Mass.
A STUDY TO VALIDATE AUTOMOBILE DRIVE TRAIN MODIFICATIONS THAT IMPROVE FUEL ECONOMY
Philip G. Gott *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 650-651 refs (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30383# Orshansky Transmission Corp., San Diego, Calif.
DESIGN FACTORS OF HYDRO-MECHANICAL TRANSMISSIONS FOR PASSENGER CARS
Peter Huntley *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 651-670 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30384# Global Scientific Engineering, Inc., Portland, Oreg.
THE INERTIAL STORAGE TRANSMISSION
Vincent E. Carman *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 671-672 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30387# Kloeckner-Humboldt-Deutz A.G., Cologne (West Germany).
A SYSTEMS ANALYSIS OF ALTERNATIVE DRIVE UNITS FOR FUTURE HEAVY DUTY TRUCKS
Wilhelm H. Fausten *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 685-690 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30388# Harker Industries, Inc., Annandale, Va.
COMBINING ENGINE COOLING WITH HEAT DRIVEN AIR CONDITIONING TO IMPROVE AUTOMOTIVE FUEL ECONOMY
Alvin Lowi, Jr. *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 691-696 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30398# Daimler-Benz, A.G., Stuttgart (West Germany).
CHARACTERISTICS OF A SINGLE-CYLINDER HYDROGEN-FUELED I.C. ENGINE USING VARIOUS MIXTURE FORMATION METHODS
K. W. Drexel and M. Gutmann *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 741-745 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30399# Daimler-Benz, A.G., Stuttgart (West Germany).
RESULTS OF HYDRIDE RESEARCH AND CONSEQUENCES FOR THE DEVELOPMENT OF HYDRIDE VEHICLES
H. Buchner *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 746-759 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30405# Transportation Systems Center, Cambridge, Mass.
HYBRID HEAT ENGINE PROPULSION OF URBAN BUSES
G. Larson *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 795-802 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30406# Volkswagen A.G., Wolfsburg (West Germany).
ELECTRIC AND HYBRID-VEHICLE POWER-TRAIN DEVELOPMENT
J. P. Altendorf *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 803-822 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30407# Wisconsin Univ., Madison.
EXPERIMENTAL EVALUATION OF A FLYWHEEL ENERGY MANAGEMENT AUTOMOBILE
N. H. Beachley *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 822-829 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30408# ESB, Inc., Yardley, Pa.
FLYWHEEL ELECTRIC MOTOR HYBRID POWER TRAIN FOR ELECTRIC VEHICLES
G. C. Kugler *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 829-845 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30410# Exxon Enterprises, Inc., New York.
COMPARATIVE EFFICIENCIES OF ALTERNATIVE FUTURE AUTOMOTIVE POWER SYSTEMS
G. P. Fetterman *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 855-864 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30411# California Univ., Livermore. Lawrence Livermore Lab.
THE FLYWHEEL-BATTERY HYBRID POWER SYSTEMS: A CONCEPT TO IMPROVE ELECTRIC VEHICLE PERFORMANCE
D. D. Davis *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 864-876 (For primary document see N78-30370 21-31)
(CONF-770430-2) Avail: NTIS HC A22/MF A01

N78-30414# AiResearch Mfg. Co., Los Angeles, Calif.
BATTERY-FLYWHEEL POWER SYSTEM FOR AN URBAN AUTOMOBILE
B. H. Rowlett *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 902-913 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30415# AiResearch Mfg. Co., Los Angeles, Calif.
A NEW LOOK AT FLYWHEEL PROPULSION FOR URBAN TRANSIT BUSES
L. J. Lawson *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 913-930 refs (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30416# California Univ., Livermore. Lawrence Livermore Lab.
THEORETICAL PERFORMANCE UPGRADING OF THE EVA ELECTRIC VEHICLE BY USE OF A FLYWHEEL/BATTERY HYBRID POWER TRAIN SYSTEM
R. C. Epps *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 930-942 (For primary document see N78-30370 21-31)
(CONF-770430-3) Avail: NTIS HC A22/MF A01

N78-30419# Little (Arthur D.), Inc., Cambridge, Mass.
PERFORMANCE CAPABILITY OF NEAR-TERM ELECTRIC AND HYBRID VEHICLES
B. B. Underhill *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 969-976 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N78-30596# Raytheon Co., Huntsville, Ala. Life Cycle Analysis Dept.
STORAGE RELIABILITY MISSILE MATERIEL PROGRAM. STORAGE RELIABILITY SUMMARY REPORT, VOLUME 2. ELECTROMECHANICAL DEVICES Final Report, Jun. 1974 - Jan. 1978
Dennis F. Malik Feb. 1978 124 p
(Contract DAAK40-74-C-0853)
(AD-A053408; LC-78-2-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 09/3

This report contains the available information on storage failure rates of electromechanical devices, summarized from other reports on accelerometers, gyroscopes, relays, and switches. The information is part of a research program being conducted by the U.S. Army Missile R and D Command, Redstone Arsenal, Alabama. The objective of this program is the development of non-operating storage reliability prediction and assurance techniques for missile materiel. GRA

N78-30597# Arinc Research Corp., Annapolis, Md.
ONE-YEAR PROGRAM PLAN FOR TEST PROGRAM SET QUALITY ASSURANCE
R. Kole and R. Tanke 1978 30 p
(Contract DAEA18-72-A-0005)
(AD-A054446; Rept-1078-01-2-1746) Avail: NTIS HC A03/MF A01 CSCL 14/2

The Automatic Test Equipment (ATE) is a major item considered during Integrated Logistic Support Planning (AR-700-127) which is required for all weapon systems. Critical elements of automatic test support are the applications software programs written to test the individual parts or subsystems of the system. These software programs are called Test Program Sets (TPSS), and the subsystems they test are called the Units Under Test (UUTs). The TPS consists of a hardware Interface Device that physically connects the UUT to the ATE, and a computer program that controls the ATE functions by automatically selecting and routing stimuli to the UUT and automatically measuring UUT response. TPS constitute more than 70% of ATE expenditures in the Army today. This report addresses the Government Product Assurance Directorate activities to initiate the establishment of effective policies and procedures for TPS quality assurance. GRA

N78-30598# National Bureau of Standards, Washington, D. C.
THE EVALUATION OF SEARCH UNITS USED FOR ULTRASONIC REFERENCE BLOCK CALIBRATIONS Interim Report, 1 Jun. - 21 Dec. 1977
Daniel J. Chwirut and Gary D. Boswell Feb. 1978 30 p refs
(PB-280311/2; NBSIR-78-1454) Avail: NTIS HC A03/MF A01 CSCL 14B

The effects of using different (nominally identical) quartz search units in the evaluation of ASTM-type standard reference blocks were determined. Various characteristics of the search units were measured and correlated with the amplitude of the ultrasonic response from reference blocks to determine which characteristics must be specified if reproducible results are to be obtained. It is shown by a series of experiments that the exact shape of the distance-amplitude curve in water (axial profile) is a primary characteristic that must be considered. When operational corrections for differences in axial profiles are made, the variability in ultrasonic responses from reference blocks, measured with different search units, was reduced from about 25 percent to 4 percent. GRA

N78-30282 Aeronautical Research Labs., Melbourne (Australia).
NDI AND THE DETECTION OF FATIGUE
I. G. Scott *In its* Aircraft Structural Fatigue Apr. 1977 p 255-267 refs (For primary document see N78-30271 21-31)
Copyright. Avail: Issuing Activity

N78-30284 Aeronautical Research Labs., Melbourne (Australia).
AIRCRAFT STRUCTURAL RELIABILITY AND RISK THEORY: A REVIEW
F. H. Hooke *In its* Aircraft Structural Fatigue Apr. 1977 p 299-344 refs (For primary document see N78-30271 21-31)
Copyright. Avail: Issuing Activity

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

N78-30599 Virginia Univ., Charlottesville.
CRACKS IN SHELLS Ph.D. Thesis
Marshall Rice Bradley 1977 106 p
Avail: Univ. Microfilms Order No. 7812117

The stress intensity factors at the tips of cracks in pressurized shells of various shapes are considered. The length of the crack is taken to be much smaller than the mimimum radius of curvature of the shell so that shallow shell theory can be used. The governing partial differential equations and boundary conditions are reduced to singular integral equations along the crack by use of Fourier transforms. The solutions of the singular integral equations depend on dimensionless crack length. Dissert. Abstr.

N78-30600# Technische Hogeschool, Delft (Netherlands).
A STUDY OF THE CRACK TIP GEOMETRY RESULTING FROM FATIGUE CRACK PROPAGATION IN AIR AND VACUUM
C. Q. Bowles Jan. 1978 76 p refs
(LR-261; ICAF-1042) Avail: NTIS HC A05/MF A01

Vacuum infiltration was used to produce plastic castings of fatigue cracks grown in laboratory air and vacuum in 2Q24-T3 and 7075-T6 alloys. Scanning electron microscopy revealed that the crack tip geometry in the two alloys was essentially the same. Crack advance in air is initially brittle in both alloys with the crack tip subsequently blunting to an elliptical geometry at maximum load. Crack advance in vacuum appears to result solely from slip activity in the absence of any active species to promote failure by tensile rupture. The crack front itself appears to be highly disorganized due to crack propagation at different levels and on different slip systems in adjacent grains of the polycrystalline materials. Castings produced at minimum load were found to have small holes corresponding to point of contact between the fracture surfaces. These contact points may show that crack closure does not occur over the full thickness of the material, but rather at discrete locations of maximum mismatch between the fracture surfaces. A.R.H.

N78-30601# Nationaal Lucht-en Ruimtevaartlaboratorium, Amsterdam (Netherlands).
RESIDUAL STRENGTH OF THE ALUMINUM ALLOY 7475-T76 AT LOW TEMPERATURES
W. G. J. Hart Oct. 1976 46 p refs
(NLR-TR-76103-U; ICAF-1000) Avail: NTIS HC A03/MF A01

Residual strength tests were performed, on 300 mm wide center-cracked panels of various thicknesses, at room temperature and at -50 C. During the tests, stable crack growth was filmed and recorded with the electric potential method. Fracture toughness was determined using the method of Feddersen.
Author

N78-30602# Technische Hogeschool, Delft (Netherlands).
THE ROLE OF ENVIRONMENT, FREQUENCY AND WAVE SHAPE DURING FATIGUE CRACK GROWTH IN ALUMINUM ALLOYS
C. Q. Bowles May 1978 177 p refs
(LR-270; ICAF-1025) Avail: NTIS HC A09/MF A01

The study consists of two parts. In Part A an experimental technique was developed for producing plastic castings of fatigue cracks by a process of vacuum infiltration. This technique allows study of the crack front and crack tip geometry in the scanning electron microscope. In Part B the role of water vapor was investigated with a computer controlled, closed loop servo-

hydraulic fatigue machine. Two types of tests were performed, both in laboratory air and in dry air (10 ppm H2O). The first tests consisted of frequency blocks having 1, 3 or 5 slow cycles (0.02 Hz) and 99, 97 or 95 fast cycles (20 Hz). In the second series of tests the sawtooth stress wave form and a sawtooth having a hold period at either the maximum or minimum stress were used to further evaluate the role of surface diffusion in promoting an environmental effect. G.Y.

N78-30603# Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).

THE INFLUENCES OF RESIDUAL STRESSES ON OSCILLATING TENSILE STRENGTH AND THE MEASUREMENT OF RESIDUAL STRESS, WITH EMPHASIS ON AIRCRAFT CONSTRUCTION [UNTERSUCHUNG DES EINFLUSSES VON EIGENSPANNUNGEN AUF DIE SCHWINGFESTIGKEIT SOWIE MESSUNG DER EIGENSPANNUNG, MIT BESONDERER BERUECKSICHTIGUNG DES FLUGZEUGBAUS]

P. Schrader and W. Schuetz 1977 105 p refs
(BMVG-FBWT-77-23) Avail: NTIS HC A06/MF A01; DOKZENTBW 30 DM

Surface rolling and coining of holes in notched specimens, shot peening of unnotched flat bars, and rolling of fillets of stepped shafts induced compressive residual stresses in aircraft components and increased fatigue life of high strength aluminum, titanium, and steel alloys. Under flight-by-flight loading the fatigue life was increased by coining 6-fold for the notched aluminum specimens, 9-fold for the titanium specimens and 3-fold for the steel specimens. Shot peening improved the fatigue life by a factor of 3 for the aluminum, and of more than 10 for the titanium and the steel. The life under a random load sequence was increased 3-fold for the rolled stepped shafts. The increases in fatigue life cannot be explained in all cases by the effect of the residual stresses alone, because they had already been reduced to zero after about 2 per cent of the fatigue life to failure of the shot peened aluminum specimens, although the fatigue life increased by a factor of 3. In the shot peened Ti- and steel specimens however, the residual stresses had not decreased after 40 percent of the life to failure. A.R.H.

N78-30604# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).

A METHOD FOR DERIVING STATISTICAL PARAMETERS FOR THE DESIGN AGAINST RANDOM STRESSES RESULTING FROM WORKING OPERATIONS

J. M. Zaschel 1978 109 p refs In GERMAN; ENGLISH summary
(FB-135; ICAF-1032) Avail: NTIS HC A06/MF A01

For the design against fatigue, two types of load-time histories have to be taken into account which are characterized by their different origins: working loads and environmental loads. In order to describe these load-time histories the sequence in time of load fluctuations must be considered besides their magnitude and number of occurrences. Because working loads mostly occur as sporadic events, their description is based on the theory of discontinuous stochastic processes. To this, so-called working segments were defined which are characterized by their arrival time, duration, and content. It is shown that the arrival time is fitted well by the Poisson distribution and the duration by the gamma distribution. Examples are given from load-time histories measured on a car, a truck, an airplane, and a rolling mill.
Author

N78-30605# Verein Deutscher Ingenieure, Duesseldorf (West Germany).

LOW CYCLE FATIGUE AT HIGH TEMPERATURES

H. Zenner 1977 17 p refs In GERMAN; ENGLISH summary
(VDI-302; ICAF-1010) Avail: NTIS HC A02/MF A01

Low-cycle fatigue at high temperatures is caused by cyclic mechanical and/or thermal loadings. Up to now, however, the studies in the laboratory are performed almost exclusively at constant temperatures. The paper presents an overview over the phenomenological material behaviour under isothermal low-cycle fatigue, i.e. cyclic stress-strain behaviour, strengthening, softening, relaxation and fatigue life to crack initiation under strain control. The influence of temperature, frequency, hold-time and environment is taken into consideration. The most important fatigue life prediction methods are reviewed and critically discussed with regard to accuracy, range of applicability and necessary material datas. Author

N78-30606*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

RECENT DEVELOPMENTS IN ANALYSIS OF CRACK PROPAGATION AND FRACTURE OF PRACTICAL MATERIALS

H. F. Hardrath, J. C. Newman, Jr., W. Elber, and C. C. Poe, Jr. Jun. 1978 20 p refs Presented at the Intern. Symp. of Fracture Mechanics, Washington, D. C., 11-13 Sep. 1978
(NASA-TM-78766) Avail: NTIS HC A02/MF A01 CSCL 20K

The limitations of linear elastic fracture mechanics in aircraft design and in the study of fatigue crack propagation in aircraft structures are discussed. NASA-Langley research to extend the capabilities of fracture mechanics to predict the maximum load that can be carried by a cracked part and to deal with aircraft design problems are reported. Achievements include: (1) improved stress intensity solutions for laboratory specimens; (2) fracture criterion for practical materials; (3) crack propagation predictions that account for mean stress and high maximum stress effects; (4) crack propagation predictions for variable amplitude loading; and (5) the prediction of crack growth and residual stress in built-up structural assemblies. These capabilities are incorporated into a first generation computerized analysis that allows for damage tolerance and tradeoffs with other disciplines to produce efficient designs that meet current airworthiness requirements.
A.R.H.

N78-30607*# Auburn Univ., Ala. Engineering Experiment Station.

SPECKLE TECHNIQUES FOR DETERMINING STRESSES IN MOVING OBJECTS Final Report

E. A. Murphree, T. F. Wilson, W. F. Ranson, and W. F. Swinson 1978 151 p refs
(Grant NsG-3109)
(NASA-CR-157549) Avail: NTIS HC A08/MF A01 CSCL 20K

Laser speckle interferometry is a relatively new experimental technique which shows promise of alleviating many difficult problems in experimental mechanics. The method utilizes simple high-resolution photographs of the surface which is illuminated by coherent light. The result is a real-time or permanently stored whole-field record of interference fringes which yields a map of displacements in the object. In this thesis, the time-average theory using the Fourier transform is developed to present the application of this technique to measurement of in-plane displacement induced by the vibration of an object. G.Y.

N78-30608# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).

RESPONSE OF A SEMI-INFINITE ELASTIC SOLID TO NORMAL AND TANGENTIAL POINT LOADS MOVING UNIFORMLY ON OR BELOW THE FREE SURFACE

C. C. J. Abell and A. Ungar Sep. 1977 22 p refs
(CSIR-SR-WISK-279; ISBN-0-7988-1199-4) Avail: NTIS HC A02/MF A01

The motion is determined of an elastic, homogeneous and isotrophic semi-infinite solid that is excited by a normal or tangential point load travelling uniformly over or beneath the free surface. Using the differential transform technique, a suitable operational representation of the moving point source yielded an exact, closed algebraic expression for the motion as a function of time. G.G.

N78-30609*# Old Dominion Univ. Research Foundation, Norfolk, Va.

ANALYTICAL AND NUMERICAL INVESTIGATION OF STRUCTURAL RESPONSE OF COMPLIANT WALL MATERIALS, PART 2 Final Report

R. Balasubramanian Aug. 1978 53 p refs
(Grant NsG-1236)
(NASA-CR-3039) Avail: NTIS HC A04/MF A01 CSCL 20K

Theoretical analysis of an electrostatically driven wall system for a compliant wall drag reduction program is reported. The electrostatic wall system is capable of producing deflections of many orders greater than the wall thicknesses and at small wavelengths. An intermediate large response theory is used for

structural analysis. The theoretical predictions are compared to bench test results, and good agreement between the two is obtained. The effects of aerodynamic loads and perturbation electric fields on the theoretical solutions are considered. It is shown that for very small wavelengths (lambda almost equals 2 mm) the aerodynamic effects can be estimated using potential theory without loss of accuracy, and the perturbation electric fields do not effect solutions as long as the deflections are less than one percent of the wavelength. Resonance effects for this type of structure are shown to be fairly small. Author

N78-30610*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
MICROSTRUCTURE AND MECHANICAL PROPERTIES OF QUENCHED AND TEMPERED 300M STEEL
J. L. Youngblood and M. Raghavan Aug. 1978 40 p refs
(NASA-TP-1288; JSC-13854; S-483) Avail: NTIS HC A03/MF A01 CSCL 11F

Type 300M steel, which is being used for the landing gear on the space shuttle orbiter, was subjected to a wide range of quenched and tempered heat treatments. The plane-strain fracture toughness and the tensile ultimate and yield strengths were evaluated. Cryogenic mechanical properties were obtained for conventionally heat-treated steel. The microstructure of all heat-treated test coupons was studied both optically and by transmission electron microscopy. Fracture surfaces were studied by means of scanning electron microscopy. Results indicate that substantial improvement in toughness with no loss in strength can be accomplished in quenched and tempered steel by austenitizing at 1255 K or higher. Low fracture toughness in conventionally austenitized 300M steel (1144 K) appears to be caused by undissolved precipitates, seen both in the submicrostructure and on the fracture surface, which promote failure by quasi-cleavage. The precipitates appeared to dissolve in the range 1200 to 1255 K. S.B.S.

N78-30611# Virginia Univ., Charlottesville. Dept. of Mechanical and Aerospace Engineering.
TRANSIENT ANALYSIS OF STRUCTURAL MEMBERS BY THE CSDT RICCATI TRANSFER MATRIX METHOD
W. D. Pilkey and F. H. Chu Mar. 1978 39 p refs
(Contract N00014-75-C-0374)
(AD-A054256; UVA/525303/MAE78/103) Avail: NTIS HC A03/MF A01 CSCL 20/11

A method for direct integration of the dynamic governing partial differential equations of motion for structural members is presented. This technique is called the continuous space discrete time (CSDT) Riccati transfer matrix method. Numerical results for bar and beam example problems indicate that the method is numerically stable and accurate for calculating the dynamic response of linear structural members. GRA

N78-30612# Texas A&M Univ., College Station. Dept. of Mathematics.
THE PROPAGATION OF A CRACK BY A RIGID WEDGE IN AN INFINITE POWER LAW VISCOELASTIC BODY Interim Report
J. R. Walton and A. Nachman 1978 32 p refs
(Grant AF-AFOSR-3290-77)
(AD-A054116; AFOSR-78-0816TR) Avail: NTIS HC A03/MF A01 CSCL 20/11

Closed form solutions are obtained for the problem of a crack propagated by a 2-dimensional rigid wedge of finite thickness in an infinite power law viscoelastic body. The distance from the crack tip to the point of contact with the wedge is determined from the assumption that in the vicinity of the crack tip, forces of cohesion act to produce a smoothly closing crack with continuous stresses. Finally, a simple formula expressing the stress intensity factor as a function of the speed of penetration and the length of the free crack surface is exhibited. Author (GRA)

N78-30613# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
TRAVELING LOADS ON THE TIMOSHENKO BEAM
Peter J. Torvik Apr. 1978 42 p refs
(AD-A054628; AFIT-TR-78-2) Avail: NTIS HC A03/MF A01 CSCL 20/11

A transverse force traveling along an infinite string or a beam at critical values of constant velocity generates unbounded amplitudes, in the absence of dissipation. This resonance is analagous to the unbounded amplitudes generated by a stationary force oscillating at one of the natural frequencies. The response of a finite elementary beam to a moving force of constant amplitude can be determined in terms of the eigenfunctions of the beam. Modification of elementary beam theory to take into account the effects of rotatory inertia and shear leads to the Timoshenko beam theory, from which a new set of eigenvalues and eigenfunctions can be determined. These eigenfunctions can be shown to have an orthogonality relationship which, although unusual, permits the solution of initial value and non-homogeneous problems. The procedure for solving such problems is given, and applied to the problem of a traveling load on a finite Timoshenko beam with arbitrary end conditions. Results are obtained for the case of pinned ends, and compared with those from elementary theory. Results of particular significance are that the distribution of critical speeds is altered significantly through inclusion of rotatory and shear effects, and that a shear wave, not present in the results from elementary theory, can be identified and is shown to play a major role in determining the response. Author (GRA)

N78-30614# Virginia Univ., Charlottesville. Dept. of Mechanical and Aerospace Engineering.
TRANSIENT RESPONSE OF CONTINUOUS VISCOELASTIC STRUCTURAL MEMBERS
W. D. Pilkey and J. Strenkowski Mar. 1978 32 p refs
(Contract N00014-75-C-0374)
(AD-A054255; UVA/525303/MAE78/102) Avail: NTIS HC A03/MF A01 CSCL 20/11

A comprehensive theory for the dynamic response of linear continuous viscoelastic structural members is formulated with a modal analysis. The constitutive relation is in the form of a hereditary integral. A general set of formulas is derived that may be used for both non-self-adjoint and self-adjoint systems of governing equations of motion. Applications include a Voigt-Kelvin beam and a viscoelastic circular plate.Author (GRA)

N78-30615# California Univ., Livermore. Lawrence Livermore Lab.
DYNAMIC CONTROL OF FRACTURE EXPERIMENTS WITH COMPLEX SPECIMENS: DESIGN AND ANALYSIS OF TIGHT CONTROLLERS
G. C. Corynen 20 Jan. 1978 102 p refs
(Contract W-7405-eng-48)
(UCRL-52387) Avail: NTIS HC A06/MF A01

Using control theory concepts that relate to the design of a closed-loop system, a specific control system problem dealing with controlling crack propagation in solid specimens is analyzed. In the process of analyzing this problem, it is shown how general control theory concepts work to solve a specific problem. This is done in a tutorial manner to aid experimentalists who may not be familiar with the control theory concepts relevant to their work. Starting with a preliminary design using available equipment, all parts and their relationship to the whole are analyzed. Studies on improving the weakest subsystem, the servovalve driver, on reducing the total error in the system, and on obtaining a stiff system (insensitive to specimen dynamics) are described. An important feature in the control strategy was a particular mix of force feedback and feedforward load-cancellation control, which not only provided a highly responsive and flexible system, but was essential in obtaining a stiff system. With linear and nonlinear stability criteria, it is shown that the linear version of the system has comfortable phase and gain margins and that the complete nonlinear system exhibits a stable and acceptable limit cycle. ERA

N78-30616# Sandia Labs., Albuquerque, N. Mex.
EXPERIMENTAL-ANALYTICAL COMPARISON OF THE DUCTILE FAILURE OF NOTCHED TENSILE BARS
S. E. Benzley, J. P Hickerson, and T. G. Priddy Oct. 1977 29 p refs
(Contract EY-76-C-04-0789)
(SAND-77-0727) Avail: NTIS HC A03/MF A01

Experimental results of the ductile failure of aluminum notched tensile bars are compared with finite strain, nonlinear, finite element calculations. This comparison allows the investigation

of mean stress dependent macroscopic theories for ductile fracture. Two such theories are examined and the results are presented in graphical form. ERA

N78-30617# Oak Ridge National Lab., Tenn.
APPROXIMATE METHOD OF ELASTIC-PLASTIC FRACTURE ANALYSIS FOR NOZZLE CORNER CRACKS
J. G. Merkle 1977 47 p refs Presented at the ASTM Symp. on the Influence of Carbon, Nitrogen, and Residual Elem. Chem. on the Behavior of Austenitic stainless Steels used in Construct. Atlanta, 14 Nov. 1977
(Contract W-7405-eng-26)
(CONF-771140-2) Avail: NTIS HC A03/MF A01

Two intermediate test vessels with inside nozzle corner cracks were pressurized to failure. One leaked without fracturing at 88 C (190 F), and the other failed by fast fracture at 24 C (75 F) as expected. The nozzle corner failure strains were 6.5 and 8.4 percent, both considerably greater than pretest plane strain estimates. The inside nozzle corner tangential strains were negative, implying transverse contraction along the crack front. Therefore, both vessels were reanalyzed, considering the effects of partial transverse restraint by means of the Irwin beta/Sub Ic/ formula. The nozzle corner pressure-strain curve was accurately estimated by either of two semiempirical equations, both of which agree with the elastic and fully plastic behavior of the vessels. Calculations of failure strain and fracture toughness corresponding to the measured final strain and flaw size are made for both vessels, and the results agree well with the measured values. ERA

N78-30618# Oak Ridge National Lab., Tenn.
RELAXATION BEHAVIOR OF 2 1/4 Cr-1 Mo STEEL UNDER MULTIPLE LOADING
R. W. Swindeman and R. L. Klueh Nov. 1977 23 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6048) Avail: NTIS HC A02/MF A01

Multiple-loading relaxation data for annealed 2 1/4 Cr-1 Mo steel are reported for times to 100 hr and for temperatures in the range 450 to 556 C. At 450 and 482 C the relaxation strength rises with the plastic flow stress, and recovery phenomena are not very significant in the time span of concern. At 510, 538, and 566 C the relaxation behavior during the first loading is unusual in the sense that for a period the relaxation rate is almost independent of stress. This behavior is thought to be associated with a strain-induced aging process, which depletes the proeutectoid ferrite of solid-solution strengtheners. At 510 C and above the plastic flow stress partially recovers during the relaxation process. At 566 C there is clear recovery in the sense that the relaxation rates after the first loading depend on the current value of stress and not on history. Multiple loading tests at 566 C on material in the normalized-and-tempered condition show no unusual behavior. ERA

N78-30619# California Univ., Livermore. Lawrence Livermore Lab.
HIGH-VELOCITY IMPACT TESTS INVOLVING THIN SPHERICAL SHELLS OF TANTALUM AND 304 STAINLESS STEEL
K. L. Steffan 26 Aug. 1977 60 p refs
(Contract W-7405-eng-48)
(UCID-17546) Avail: NTIS MF A04/MF A01

Flyer-plate impact tests using thin shells of annealed 304 stainless steel and annealed tantalum were conducted at impact velocities of 28 to 180 m/s in order to improve computer modeling of impact phenomena in the design of a fissile-material container able to withstand 335 m/s impact. No active instrumentation was used. Pre- and post-test measurement of interior and exterior dot patterns etched on the shells provided surface-strain information. Radiographs of the deformed shells provided shell-contour data that were plotted vs. impact velocity. Curves were fit to these data. Normalized crush height varies almost linearly with impact velocity for both materials. Normalized radius of contact varies directly with impact velocity for both materials but appears independent of shell thickness for tantalum, and normalized interior-fold radius varies inversely with impact velocity and directly with shell thickness for stainless steel. No clear relationship appears for tantalum. ERA

N78-30620# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
COMPILATION OF TEST DATA FROM AN INVESTIGATION ON THE EFFECT OF ENVIRONMENT ON CRACK GROWTH UNDER FLIGHT-SIMULATION LOADING
3 Sep. 1976 39 p refs Supplement to NLR-TR-76104
(Contract NIVR-1725)
(NLR-TR-76096-U; NLR-TR-76104) Avail: NTIS HC A03/MF A01

The present report is a supplement to NLR-TR-76104. Numerical test results and several evaluations are given in full detail. However, the discussion of the results is presented in NLR-TR-76104. Author (ESA)

N78-30621# Centre National d'Etudes Spatiales, Toulouse (France).
DYNAMIC STRUCTURE IDENTIFICATION: MODAL ANALYSIS TESTS [IDENTIFICATION DYNAMIQUE DES STRUCTURES: LES ESSAIS D'ANALYSE MODALE]
Alain Girard Nov. 1977 34 p refs In FRENCH; ENGLISH summary
(CNES-NT-77) Avail: NTIS HC A03/MF A01

Various techniques currently used to identify structures by modal analysis tests are discussed. The real or complex mode concept is introduced from the equations of motion. This allows specification of the parameters to be determined during tests according to the approach selected. The test methods are then classified in two categories, according to whether they require isolation of modes or not, and described in detail as to their individual characteristics. Some trends are noted with regard to future evolution of techniques. Author (ESA)

N78-30622# National Engineering Lab., East Kilbride (Scotland). Strength of Components and Fatigue Div.
MODAL ANALYSIS OF TRANSIENT RESPONSE DATA USING A COMPLEX EXPONENTIAL ALGORITHM
W. H. Dunn Aug. 1977 18 p refs Presented at the SEECO77 Conf. on Signal Process. for Vibration, Shock and Noise, London, Apr. 1977
(NEL-641) Avail: NTIS HC A02/MF A01

A method for obtaining modal information from the free transient response of a vibrating structure is described. The Prony series algorithm, which is a numerical procedure for converting a digital function into a sum of complex exponentials has been used for computer programming. ESA

N78-30623# National Engineering Lab., East Kilbride (Scotland). Strength of Components and Fatigue Div.
SIGNAL PROCESSING FOR ADVANCED STRUCTURAL TESTING
W. P. McKinlay and D. H. D. Robertson Oct. 1977 26 p refs Presented at the SEECO77 Conf. on Signal Process. for Vibration, Shock and Noise, London, Apr. 1977
(NEL-644) Avail: NTIS HC A03/MF A01

Signal processing techniques for producing displacement control signals for a multi-actuator structure endurance test on a commercial vehicle cab and chassis assembly are described. Signals were derived from acceleration responses at positions on the chassis as the vehicle travels along a test track. Author (ESA)

N78-30624# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Section Construction Metallique.
BENDING OF RECTANGULAR PLATES SUBJECTED TO A UNIFORMLY DISTRIBUTED LATERAL LOAD
Rudy Beeckman and Daniel vanLeeuwen Oct. 1977 33 p refs Sponsored by Inst. pour l'Encour. de la Rech. Sci. dans l'Ind. et l'Agr.
(CRIF-MT-118) Avail: NTIS HC A03/MF A01

A general analytical treatment is given for the deflection and stress distribution in a rectangular plate subjected to a uniformly distributed lateral load. Two opposite edges were simply supported, the two remaining edges were elastically supported by beams. By changing the flexural and torsional rigidity of one or both beams, a variety of particular boundary conditions was easily obtained from the analysis of the general case. Author (ESA)

N78-30625# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Section Construction Metallique.

INFLUENCE OF ANGULAR DISTORTION AT A LONGITUDINAL JOINT OF A CYLINDRICAL PRESSURE VESSEL

Arnold Sys Oct. 1977 24 p refs Repr. from 3d Intern. Conf. on Pressure Vessel Technol., Pt 2 Am. Soc. of Mech. Engr. Sponsored by Inst. pour l'Encour. de la Rech. Sci. dans l'Ind. et l'Agr.

(CRIF-MT-120) Avail: NTIS HC A02/MF A01

Tests were executed on six pressure models about 595 mm in diameter, 10 mm thick, and 1,500 mm long. The length of the flattening measured from the axis of the longitudinal seam ranged from 30 to 50 mm for the different vessels. The radius of curvature from cylinder to flat was 60 mm for all models. The angle between the surfaces of the two flats next to the welded seam was > or < 180 deg, which means that the angular distortion is positive for some tests and negative for others. Strain gages were placed both at the inside and at the outside in the neighborhood of the longitudinal seam. At different steps during the static pressure test up to 6 N/sq mm, the strains from which the corresponding stresses are derived were recorded. On two of the six test vessels, a fatigue test under pulsating internal pressure was performed in order to evaluate the effect of peak stresses around the longitudinal weld. Using Castigliano's theorem, the relation between the stress concentration factor and the geometrical data defining the angular discontinuity was found. Comparison between the experimental results and the theoretical values show a good correlation. Considering the supplementary stresses as primary bending stresses and using the ASME acceptance criterion, a method is given to determine the tolerances of an angular distortion at a longitudinal joint of a cylindrical pressure vessel. Author (ESA)

N78-30626# Loughborough Univ. of Technology (England). Dept. of Transport Technology.

ON THE STRUCTURAL RESPONSE OF STEEL CHIMNEYS WITH ADDED DAMPING

M. G. Milsted Jun. 1977 43 p refs Presented at the Euromech Colloq. No. 89 on Vibration Control by Damping, Lyon, Jun. 1977

(Grant SRC-B/RG/3701-8)

(TT-7707) Avail: NTIS HC A03/MF A01

Contributions to the overall damping level from radiation losses in the soil and from an added damping layer at the base of the chimney are examined. Soil-structure interactions are shown to produce similar dynamic effects on chimneys with a wide range of heights. The shape of the foundation is seen to influence the system damping level, particularly in the higher modes of vibration. Fully embedded, deep foundations are found to provide more damping than slab-type foundations; however, it appears impracticable to use this shape effect to significantly increase the damping in the fundamental mode of vibration. A damping layer between the chimney and the foundation block is shown to be effective in all the important modes of vibration providing it is more flexible than the soil supporting the foundation block. Further work is in progress to more fully determine the merits of the concept. Author (ESA)

N78-30627# Royal Aircraft Establishment, Farnborough (England). Structures Dept.

A COMPUTER PROGRAM FOR THE INTERPOLATION AND EXTRAPOLATION OF CRACK PROPAGATION DATA

P. R. Edwards London Aeron. Res. Council 1977 38 p refs Supersedes RAE-TR-76115; ARC-37160

(ARC-CP-1387; RAE-TR-76115; ARC-37160) Avail: NTIS HC A03/MF A01; HMSO £2; PHI $7.65

A computer program was written which extracts crack propagation rates from crack rate data, given mean and alternating stress intensity factors. Data required is a set of between one and 11 curves of crack rate against alternating stress intensity factor for a range of values of stress ratio. The program then interpolates between the specified data points or extrapolates outside them in order to calculate the crack rate. An empirical correction for sheet thickness is included. Author (ESA)

N78-30628# Transport and Road Research Lab., Crowthorne (England). Earthworks and Underground Pipes Div.

FINITE ELEMENT ANALYSIS OF A LARGE DIAMETER BURIED STEEL PIPELINE

P. Nath 1977 27 p refs

(PB-280134/8; TRRL-LR-778; ISSN-0305-1293) Avail: NTIS HC A03/MF A01 CSCL 13B

In a buried pipe, the stresses and displacements produced during placement and compaction of the backfill are difficult to predict theoretically because their values are strongly influenced by the construction procedures employed on site. However, the displacements and stresses produced by the weight of the materials and loads applied to the completed structure are amenable to direct theoretical analysis. The finite element analysis of the structural performance of a 1.83m internal diameter steel pipe is compared with experimental field measurements carried out on such a pipe. The calculated results are in good agreement with the experimental values. GRA

N78-30629# Sydney Univ. (Australia). Civil Engineering Labs.

APPLICATION OF THE FINITE ELEMENT METHOD TO THE PREDICTION OF COLLAPSE LOADS

R. R. Rowe and E. H. Davis Sep. 1977 70 p

(PB-280287/4; R-310) Avail: NTIS HC A04/MF A01 CSCL 13M

The application of elasto-plastic finite element methods to the pre-techniques are presented for the estimation of numerical collapse loads, and by consideration of a number of examples it is shown that both techniques give a better estimate of the collapse load for a particular problem than would otherwise have been obtained with the same numerical sophistication. Both these techniques can be applied to a wide range of problems, however it is anticipated that the first technique will provide a useful practical estimate of the collapse load for a given problem, while the second technique can be adopted when a more detailed investigation of the effect of soil-structure interaction is required. GRA

N78-30630# Swedish Council for Building Research, Stockholm.

THIN-WALLED C-SHAPED PANELS IN AXIAL COMPRESSION

Per-Olof Thomasson 1978 288 p refs

(PB-280019/1; ISBN-91-540-2820-5) Avail: NTIS HC A13/MF A01 CSCL 13M

Thin-walled C-type panels of steel sheeting which are subjected to axial loading are examined. By joining together individual panels, it is possible to produce stressed skin members which have both a loadbearing and space-separating function, for instance as parts of a wall. When acting as loadbearing members in a wall, the panels will be subjected mainly to axial loads. Owing to the characteristic construction of the panels from thin cross sectional elements, stability problems of various kinds are of decisive significance with regard to structural behavior and loadbearing capacity. GRA

N78-30273 Aeronautical Research Labs., Melbourne (Australia).

MECHANISMS OF FATIGUE AND FRACTURE

S. P. Lynch *In its* Aircraft Structural Fatigue Apr. 1977 p 25-55 refs (For primary document see N78-30271 21-31)

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N78-30278 Aeronautical Research Labs., Melbourne (Australia).

FATIGUE S/N DATA IN RELATION TO VARIABILITY IN PREDICTED LIFE

J. M. Finney and J. Y. Mann *In its* Aircraft Structural Fatigue Apr. 1977 p 149-178 refs (For primary document see N78-30271 21-31)

Copyright. Avail: Issuing Activity

N78-30279 Aeronautical Research Labs., Melbourne (Australia).

STRUCTURAL FATIGUE TESTING

R. A. Bruton and C. A. Patching *In its* Aircraft Structural Fatigue Apr. 1977 p 179-202 refs (For primary document see N78-30271 21-31)

Copyright. Avail: Issuing Activity

N78-30280 Aeronautical Research Labs., Melbourne (Australia).

CURRENT DEVELOPMENTS IN THE LIFE OF AIRCRAFT STRUCTURE

A. O. Payne *In its* Aircraft Structural Fatigue Apr. 1977 p 205-226 refs (For primary document see N78-30271 21-31)
Copyright. Avail: Issuing Activity

N78-30283 Aeronautical Research Labs., Melbourne (Australia).
THE DEVELOPMENT OF THE THEORY OF STRUCTURAL FATIGUE
D. G. Ford *In its* Aircraft Structural Fatigue Apr. 1977 p 269-298 refs (For primary document see N78-30271 21-31)
Copyright. Avail: Issuing Activity

N78-30285 Aeronautical Research Labs., Melbourne (Australia).
LOAD INTERACTION EFFECTS IN FATIGUE CRACK PROPAGATION
G. W. Revill, Ningaiah, and J. M. Finney *In its* Aircraft Structural Fatigue Apr. 1977 p 347-372 refs (For primary document see N78-30271 21-31)
Copyright. Avail: Issuing Activity

N78-30286 Aeronautical Research Labs., Melbourne (Australia).
A MODEL OF CRACK-TIP BEHAVIOUR FOR FATIGUE LIFE DETERMINATION
F. P. Bullen, J. A. Retchford, C. B. Rogers, and B. J. Wicks *In its* Aircraft Structural Fatigue Apr. 1977 p 373-391 refs (For primary document see N78-30271 21-31)
Copyright. Avail: Issuing Activity

N78-30287 Aeronautical Research Labs., Melbourne (Australia).
FATIGUE-CRACK GROWTH AND FRACTURE IN D6AC STEEL
N. E. Ryan *In its* Aircraft Structural Fatigue Apr. 1977 p 393-418 refs (For primary document see N78-30271 21-31)
Copyright. Avail: Issuing Activity

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

N78-30631 Wyoming Univ., Laramie.
PREDICTING THE SURFACE WIND CHARACTERISTICS OF SOUTHERN WYOMING FROM REMOTE SENSING AND EOLIAN GEOMORPHOLOGY Ph.D. Thesis
Kenneth Edward Kolm 1977 174 p
Avail: Univ. Microfilms Order No. 7811698

LANDSAT image interpretations of sand dune fields were correlated with meteorological data to show that the presence of active dunes indicates a windy climate, the elongation of dunes and dune fields indicates dominant direction, persistence, and strength of wind flow in a given area, and the boundaries of dune fields indicate confluence, difluence, and other patterns of wind flow. Aerial photo interpretations and statistical analyses of sand dune features that were correlated with meteorological data reveal that individual dune forms record the dominant wind direction across the area, dune spacings and alignments depict local windflow patterns, and parabolic dunes created from stabilized sand are independent of the immediate structure and statigraphy and can therefore be used as both a summer wind velocity and climatic indicator. Dissert. Abstr.

N78-30632 California Univ., Berkeley.
HYDRAULIC ADJUSTMENT OF AN ALLUVIAL STREAM CHANNEL TO THE SUPPLY OF SEDIMENT Ph.D. Thesis
Edmund Daniel Andrews 1977 161 p
Avail: Univ. Microfilms Order No. 78-12473

A bedload trap located on the East Fork River, Wyoming, provided direct field measurements of bedload transport and an opportunity to study the hydraulic adjustment of an alluvial stream to the particular combination of sediment and water it carries. The downstream hydraulic geometry of the studied portion of the East Fork River differed considerably from the observed mean condition of rivers in the midwestern United States. A comparison of the hydraulic characteristics of the bankfull discharges in the study reaches above and below Muddy Creek showed that mean velocity and depth increase downstream more rapidly, while width increases less rapidly, than the mean midwestern condition. The observed East Fork River hydraulic exponents agree exactly with exponents computed by minimizing the variance of velocity, width, depth, and stream power per unit length and per unit area with the constraints that slope is independent and the concentration of sediment per unit width of active bed is constant. Dissert. Abstr.

N78-30633 Minnesota Univ., Minneapolis.
AN OPTIMIZATION TECHNIQUE FOR A MATHEMATICAL URBAN RUNOFF MODEL Ph.D. Thesis
Chung Sang Chu 1978 203 p
Avail: Univ. Microfilms Order No. 78-13388

A simple mathematical urban runoff model including an automatic optimization technique was developed. The modified Holtan's infiltration and the Soil Conservation Service triangular unit hydrograph procedure were used in the model. Seven available optimization techniques were tested with the proposed model. Among the tested techniques were: (1) univariate gradient method, (2) pattern search, (3) Rosenbrock method, (4) Box-Complex, and three of the latest gradient type techniques. The Box-Complex method produced consistently good results. The proposed model with modification of the Box-Complex method was applied to the Oakdale Avenue Drainage Basin in Chicago. The performance of this model was compared with the performance of other available leading mathematical models. Dissert. Abstr.

N78-30634*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOME OBSERVATIONS ABOUT LANDSAT DIGITAL ANALYSIS
Robert R. Jayroe, Jr. Aug. 1978 40 p
(NASA-TM-78184) Avail: NTIS HC A03/MF A01 CSCL 05B

Several hypotheses concerning LANDSAT data are analyzed. These hypotheses are: (1) LANDSAT does not discriminate vegetation types, but mostly sees chlorophyl and canopy cover. (2) A majority of the features in the ground scene possess linearly proportional amounts of color from each spectral band. (3) The data are continuous and as a result there is no true separability of ground scene features in the data, but some features possess an excess of color in a particular band pair. (4) There are relatively few features present in the spectral data, and these do not correspond to the conventional definitions that are used. (5) Aside from seasonal effects, in a distributional sense all LANDSAT data are essentially the same. The only difference is the way the data are spatially arranged in the image. S.B.S.

N78-30635*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLICATION OF MULTISPECTRAL RADAR AND LANDSAT IMAGERY TO GEOLOGIC MAPPING IN DEATH VALLEY
M. Daily, C. Elachi, T. Farr, W. Stromberg, S. Williams, and G. Schaber (Geol. Surv., Flagstaff, Ariz.) 30 Mar. 1978 59 p refs Original contains color illustrations
(Contract NAS7-100)
(NASA-CR-157557; JPL-Pub-78-19) Avail: NTIS HC A04/MF A01 CSCL 08B

Side-Looking Airborne Radar (SLAR) images, acquired by JPL and Strategic Air Command Systems, and visible and near-infrared LANDSAT imagery were applied to studies of the Quatenary alluvial and evaporite deposits in Death Valley, California. Unprocessed radar imagery revealed considerable variation in microwave backscatter, generally correlated with surface roughness. For Death Valley, LANDSAT imagery is of limited value in discriminating the Quaternary units except for alluvial units distinguishable by presence or absence of desert varnish or evaporite units whose extremely rough surfaces are

strongly shadowed. In contrast, radar returns are most strongly dependent on surface roughness, a property more strongly correlated with surficial geology than is surface chemistry.
Author

N78-30636*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A CLOSED NETWORK QUEUE MODEL OF UNDERGROUND COAL MINING PRODUCTION, FAILURE, AND REPAIR
G. M. Lohman 15 Aug. 1978 52 p refs Sponsored by DOE
(Contract NAS7-100)
(NASA-CR-157554; JPL-Pub-78-72) Avail: NTIS HC A04/MF A01 CSCL 08I

Underground coal mining system production, failures, and repair cycles were mathematically modeled as a closed network of two queues in series. The model was designed to better understand the technological constraints on availability of current underground mining systems, and to develop guidelines for estimating the availability of advanced mining systems and their associated needs for spares as well as production and maintenance personnel. It was found that: mine performance is theoretically limited by the maintainability ratio, significant gains in availability appear possible by means of small improvements in the time between failures the number of crews and sections should be properly balanced for any given maintainability ratio, and main haulage systems closest to the mine mouth require the most attention to reliability. S.B.S.

N78-30637*# General Electric Co., Huntsville, Ala. Space Div.
GLOBAL CROP PRODUCTION FORECASTING: AN ANALYSIS OF THE DATA SYSTEM PROBLEMS AND THEIR SOLUTIONS
J. Neiers and H. Graf May 1978 83 p refs
(Contract NAS8-32491)
(NASA-CR-150749; Rept-78HV031) Avail: NTIS HC A05/MF A01 CSCL 02C

Data related problems in the acquisition and use of satellite data necessary for operational forecasting of global crop production are considered for the purpose of establishing a measurable baseline. For data acquisition the world was divided into 37 crop regions in 22 countries. These regions represent approximately 95 percent of the total world production of the selected crops of interest, i.e., wheat, corn, soybeans, and rice. Targets were assigned to each region. Limited time periods during which data could be taken (windows) were assigned to each target. Each target was assigned to a cloud region. The DSDS was used to measure the success of obtaining data for each target during the specified windows for the regional cloud conditions and the specific alternatives being analyzed. The results of this study suggest several approaches for an operational system that will perform satisfactorily with two LANDSAT type satellites. G.G.

N78-30638# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
REMOTE SENSING APPLIED TO REGIONAL GEOLOGICAL MAPPING IN THE SAO FRANCISCO RIVER AREA M.S. Thesis [SENSORIAMENTO REMOTO APLICADO AO MAPEAMENTO GEOLOGICO REGIONAL: FOLHA RIO SAO FRANCISCO]
Athos Ribeiro DosSantos, Paulo Roberto Meneses, and Ubiratan Porto DosSantos Sep. 1977 181 p refs In PORTUGUESE; ENGLISH summary
(INPE-1111-TPT/064) Avail: NTIS HC A09/MF A01

A working method that permits the integrated interpretation of various available products of remote sensing was developed for LANDSAT 1 multispectral imagery, Project RADAM's radar (SLAR) mosaics, and the black and white and colored multispectral photographs of SKYLAB for regional geological mapping. The two geological provinces considered are the southeastern part of the Parnaiba Sedimentary Basin and an area of Precambrian metamorphic rocks. In the Precambrian area the stratigraphy was changed as follows: the San Marcos formation was extended to Estreito and Boqueirao ranges; the Rio Preto group was differentiated. The existence of two members in the Ipupiara Formation was reconsidered. B.B.

N78-30639*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MONITORING CORN AND SOYBEAN CROP DEVELOPMENT BY REMOTE SENSING TECHNIQUES
Compton J. Tucker, James H. Elgin, Jr., and James E. McMurtrey, III Aug. 1978 16 p refs
(NASA-TM-79607) Avail: NTIS HC A02/MF A01 CSCL 02C

A system for spectrally monitoring the stages of crop development for corn and soybeans based upon red and photographic infrared spectral radiances is proposed. The red and photographic infrared spectral radiance, highly correlated with the green leaf area index or geen leaf biomass, enable nondestructive monitoring of the crop canopy throughout the growing season. Five distinct periods are apparent which are related to crop development for corn and soybeans. Author

N78-30640# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Electrical and Systems Engineering.
SOME NEW MAP DATA ENCODING SCHEMES Interim Report
Herbert Freeman 1978 11 p refs
(Grant AF-AFOSR-2937-76)
(AD-A054853; AFOSR-78-0946TR) Avail: NTIS HC A02/MF A01 CSCL 09/4

Some new schemes for encoding map data are introduced. The schemes can be regarded as generalizations of the well known 8-direction chain coding scheme. Instead of being limited to 8 types of links for approximating a curve, the new schemes possess 16, 24, 32, 48, or even more link types. The new schemes permit increased smoothness of representation, exhibit greater precision, and require less processing time for comparable resolution than present methods. Author (GRA)

N78-30641# Energy Research and Development Administration, Laramie, Wyo. Energy Research Center.
THERMAL ANALYSIS ON OIL SHALE: DETERMINATION OF POTENTIAL OIL YIELDS AND DAWSONITE, NAHCOLITE, AND NORDSTRANDITE CONTENT
Donald R. Johnson, N. B. Young, and J. W. Smith 1977 20 p refs
(LERC/RI-77/6) Avail: NTIS HC A02/MF A01

Thermal analysis was applied to Green River Formation oil shales to demonstrate the method's capabilities for estimating oil yields and for determining dawsonite, nahcolite and nordstrandite. A single sample heated in thermal analysis apparatus incorporating differential thermal analysis and thermogravimetry will produce quantitative data on the three oil shale minerals and excellent oil yield estimates. Coefficients of determination ranged from 0.88 for dawsonite and nordstrandite determinations to 0.998 for nahcolite. Requirements to be met by thermal analysis equipment to obtain accurate oil shale compositional data are outlined. The method is especially useful where minerals are encountered that interfere with other analytical techniques. ERA

N78-30642# Los Alamos Scientific Lab., N. Mex.
HYBRID COMPUTERS FOR SIMULATION OF GAS DIFFUSION IN FRACTURED SHALE
Thomas E. Springer 1977 11 p refs Presented at Eastern Gas Shale Program Conf., Morgantown, W. Va., 17-19 Oct. 1977
(Contract W-7405-eng-36)
(LA-UR-77-2066; Conf-771038-1) Avail: NTIS HC A02/MF A01

To stimulate gas recovery from Devonian shales, extraction technologies may include hydraulic, explosive, and natural fractures, chemical leaching, and gas displacement. A computational technique is described using a hybrid (analog and digital) computer whose ultimate objective will involve simulation of experiments based on proposed extraction technologies to establish optimum economic stimulation methods. The technique has the potential use of determining expected values of production when only statistical distributions of crack densities, permeabilities, and other geophysical properties are known. ERA

N78-30643# California Univ., Berkeley. Lawrence Berkeley Lab.
NORTHERN NEVADA GEOTHERMAL EXPLORATION STRATEGY ANALYSIS

N. E. Goldstein Dec. 1977 58 p
(Contract W-7405-eng-48)
(LBL-7012) Avail: NTIS HC A04/MF A01

The results of exploration techniques applied to geothermal resource investigations in northern Nevada were evaluated and rated. A quantitative rating scheme was used to obtain estimates of technique effectiveness. From survey cost information cost-effectiveness estimates for the various techniques were also obtained and compared. Effectiveness estimates were used to develop an exploration strategy for the area. However, because no deep confirmatory drilling has been done yet, the technique evaluations and exploration strategy must be considered as preliminary. The strategy was further studied by means of a decision tree analysis, merging the strategy with the timing of land acquisition and deep drilling to find the scenario that gives the highest cost-effectiveness values for drilling success, overall project success, and maximum expected returns on exploration investment. Based on assumed probabilities it is shown that land acquisition should be deferred until after the basic detail-phase exploration is completed. The cost effectiveness of the initial confirmatory drill hole will be a maximum when land acquisition is followed by a supplemental detail-phase program, but this approach does not lead to the highest expected return on investment. ERA

N78-30644# Sandia Labs., Albuquerque, N. Mex. Waste Isolation Pilot Plant.

HYDROLOGIC INVESTIGATIONS OF THE LOS MEDANOS AREA, SOUTHEASTERN NEW MEXICO, 1977

Steven J. Lambert and Jerry W. Mercer (US Geolocial Survey, Albuquerque, New Mexico) 1 Dec. 1977 63 p refs
(Contract EY-76-C-04-0789)
(SAND-77-1401) Avail: NTIS HC A04/MF A01

The philosophy and strategy for studying the hydrologic conditions in an area under consideration for the emplacement of radioactive wastes in geologic media was outlined. Areas of study are the following; (1) program plan for hydrologic investigation; (2) plan for hydrologic drilling and testing of area; (3) generalized program plan for hydrologic investigation of rocks underlying the waste isolation pilot plant; and (4) detailed plan of hydrologic testing in holes penetrating salt underlaying the pilot plant. Author (ERA)

N78-30645# GEC-Marconi Electronics Ltd., Chelmsford (England).

DEFINITION OF A GROUND SAR PROCESSOR FOR SEASAT-A Final Report

A. B. E. Ellis, S. R. Brooks, and W. T. Welford (Imp. Coll. of Sci. and Technol.) Paris ESA 1978 194 p refs
(Contract ESTEC-3154/77-NL-HP(SC))
(ESA-CR(P)-1060) Avail: NTIS HC A09/MF A01

Results are presented of the definition study for a ground Synthetic Aperture Radar (SAR) processor for Seasat-A. The ground processor is required to accept both SAR and auxiliary data and any external control signals. It must compress the SAR data in both range and azimuth in order to produce image data at the output, preferably on computer-compatible tape. Three options have been considered for the processor, and a general purpose array processor. The preferred solution is the array processor in view of its flexibility. However, it is the most costly solution and also will require software changes. ESA

N78-30646# Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).

THE PHOTOGRAMMETRIC BUNDLE ADJUSTMENT AND THE RESOLUTION OF LARGE NORMAL EQUATIONS SYSTEMS Ph.D. Thesis - Tech. Hochschule Darmstadt, West Ger. [DIE PHOTOGRAMMETRISCHE BUENDELAUSGLEICHUNG UND DIE AUFLOESUNG GROSSER NORMALGLEICHUNGSSYSTEME]

Kurt Haag Bayerische Akad. der Wiss. 1977 114 p refs In GERMAN
(Ser-C/Diss-232; ISBN-3-7696-9288-8) Avail: NTIS HC A06/MF A01

The application of bundle adjustment to photogrammetry is discussed. Approaches dealt with include a functional and stochastic model, the representation equation and the rotation matrix, stochastic properties of the image coordinates, and the taking into account of failures in the terrestrial pass points. The equation and the matrix structures of bundle adjustment and their application in a bundle adjustment program are discussed. Algorithms for solving linear equation systems, and the applications known so far in photogrammetry, are surveyed. Various procedures for the direct solving of large linear equation systems with sparsely occupied coefficient matrices are discussed. ESA

N78-30647# National Technical Information Service, Springfield, Va.

EFFECTS OF LAND USE AND URBANIZATION ON WATER RESOURCES AND WATER QUALITY, VOLUME 1. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1971 - 1976

Edward J. Lehmann May 1978 190 p
(NTIS/PS-78/0487/5) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

A bibliography containing 184 abstracts concerning general studies on the effects of land use and urbanization on water supply and water quality is presented. Reports on specific localities were included, if they may be applied to other areas. Basic research on the relationship between land use and water quality management was also examined. GRA

N78-30648# National Technical Information Service, Springfield, Va.

EFFECT OF LAND USE AND URBANIZATION ON WATER RESOURCES AND WATER QUALITY, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1977 - May 1978

Edward J. Lehmann May 1978 85 p Supersedes NTIS/PS-77/0420 NTIS/PS-76/0369, NTIS/PS-75/401, and COM-73-11695
(NTIS/PS-78/0488/3; NTIS/PS-77/0420; NTIS/PS-76/0369; NTIS/PS-75/401; COM-73-11695) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

General studies on the effects of land use and urbanization on water supply and water quality are presented. Reports on specific localities are included, if they may be applied to other areas. These citations not only include local, state, and national government policies and planning affecting land development, but also basic research on the relationship between land use and water quality management. GRA

N78-30649# Arkansas Univ., Fayetteville. Water Resources Research Center.

ANALYSIS OF PRIORITY WATER RESOURCES PROBLEMS FOR THE SOUTHERN PLAINS REGION Final Report, 1 Oct. 1976 - 30 Sep. 1977

Robert E. Babcock, Garrey E. Carruthers, Elvin J. Dantin, Marvin T. Edmison, and William L. Powers 1 Sep. 1977 51 p
(Contract DI-14-34-0001-7204)
(PB-280235/3; W78-06207; OWRT-B-214-TEX(1)) Avail: NTIS HC A04/MF A01 CSCL 13B

State water resources research institutes in the Southern Plains Region of the U.S. (Arkansas, Kansas, Louisiana, New Mexico, Oklahoma, and Texas) have identified their critical and serious water resources problems and research needs. These problems are summarized by each state in the report. Funding is outlined through fiscal year 1978. GRA

N78-30650# Geological Survey, Fort Buchanan (Puerto Rico). Water Resources Div.

LIMNOLOGY OF LAGUNA TORTUGUERO, PUERTO RICO Final Report

Ferdinand Quinones-Marquez and Luis A. Fuste Mar. 1978 92 p refs
(PB-280322/9; USGS/WRD/WRI-78/027; USGS/WRI-77-122) Avail: NTIS HC A05/MF A01 CSCL 08H

The principal chemical, physical and biological characteristics, as well as the hydrology of Laguna Tortuguero, Puerto Rico, were studied from 1974-75. The lagoon, with an area of 2.24 square kilometers and a volume of about 2.68 million cubic meters, contains about 5 percent of seawater. Drainage through a canal on the north side averages 0.64 cubic meters per second per day, flushing the lagoon about 7.5 times per year. Chloride and sodium are the principal ions in the water, ranging from

300 to 700 mg/l and 150 to 400 mg/l, respectively. Among the nutrients, nitrogen averages about 1.7 milligrams per liter, exceeding phosphorus in a weight ratio of 170:1. GRA

N78-30651# National Weather Service, Kansas City, Mo.
GUIDELINES FOR FLASH FLOOD AND SMALL TRIBUTARY FLOOD PREDICTION
Lawrence A. Hughes and Lawrence L. Longsdorf Mar. 1978 12 p refs Revised
(PB-281461/4; NOAA-TM-NWS-CR-58-Rev;
NOAA-78041225) Avail: NTIS HC A02/MF A01 CSCL 08H

A structured step-by-step approach is reported for determining the threat and extent of flash floods and other small tributary floods. Basically, this involved knowledge of when, how much, and how fast rain came down and some method for converting this to river stage of flood potential. This note discusses anticipating and locating heavy rain areas and considering the flash flood watch. Rainfall is estimated from radar data and the flash flood warning is considered. The extent of the flood is estimated from the use of flood indices and flood advisory tables. GRA

N78-30652# Geological Survey, Memphis, Tenn. Water Resources Div.
PRELIMINARY EVALUATION OF FLOOD FREQUENCY RELATIONS IN THE URBAN AREAS OF MEMPHIS, TENNESSEE
Charles W. Boning Mar. 1978 58 p refs Sponsored by the city of Memphis and Shelby County, Tenn.
(PB-280310/4; USGS/WRI-77-132; USGS-WRD-WRI-78-028) Avail: NTIS HC A04/MF A01 CSCL 08H

A storm-runoff relation for streams in the urban areas of Memphis was determined by a statistical evaluation of 59 flood discharges from 19 gaging stations. These flood discharges were related to drainage area, percent imperviousness of the drainage basin, and rainfall occurring over 120-minute periods. The defined relation was used to synthesize sets of annual flood peaks for drainage basins ranging from .05 square miles to 10 square miles and imperviousness ranging from 0 to 80 percent for the period of rainfall record at Memphis. From these series of flood peaks, frequency relations were defined and presented for 2, 5, 10, 25, 50 and 100 year recurrent intervals. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N78-30653 Oklahoma State Univ., Stillwater.
TRANSIENT BEHAVIOR OF WIND DRIVEN SYNCHRONOUS MACHINES Ph.D. Thesis
Abdul Qavi Qazi 1977 156 p
Avail: Univ. Microfilms Order No. 7811064

The transient behavior of wind driven synchronous machines under conditions of wind gusts and faults for various system configurations were investigated and design recommendations from the view point of electrical stability and energy delivered to the utility grid were made. This task was performed in the following steps: (1) formulate the mathematical model for each identified and selected system configuration, (2) solve the sets of non-linear differential equations by employing an appropriate numerical technique and digital simulation, (3) present the results in the form of curves (4) interpret these curves, (5) draw some useful conclusions and (6) suggest areas for future research work. Dissert. Abstr.

N78-30654*# IBM Federal Systems Div., Huntsville, Ala.
SYSTEM INTEGRATION OF MARKETABLE SUBSYSTEMS Second Collection of Progress Reports
Jul. 1978 68 p Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-150742) Avail: NTIS HC A04/MF A01 CSCL 10A

These monthly reports, covering the period February 1978 through June 1978, describe the progress made in the major areas of the program. The areas covered are: systems integration of marketable subsystems; development, design, and building of site data acquisition subsystems; development and operation of the central data processing system; operation of the MSFC Solar Test Facility; and systems analysis. S.B.S.

N78-30655*# International Business Machines Corp., Hopewell Junction, N. Y. East Fishkill Labs.
SILICON RIBBON GROWTH BY A CAPILLARY ACTION SHAPING TECHNIQUE Final Report, 8 May 1975 - 8 Nov. 1977
G. H. Schwuttke, G. H. Schwuttke, T. F. Ciszek, and A. Kran 8 Nov. 1977 352 p refs Prepared for JPL and DOE
(Contracts NAS7-100; JPL-954144)
(NASA-CR-157547; DOE/JPL-954144-78/1) Avail: NTIS HC A16/MF A01 CSCL 10A

Substantial improvements in ribbon surface quality are achieved with a higher melt meniscus than that attainable with the film-fed (EFG) growth technique. A capillary action shaping method is described in which meniscus shaping for the desired ribbon geometry occurs at the vertex of a wettable die. As ribbon growth depletes the melt meniscus, capillary action supplies replacement material. Topics discussed cover experimental apparatus and growth procedures; die materials investigations, fabrication and evaluation; process development for 25 mm, 38 mm, 50 mm and 100 mm silicon ribbons; and long grain direct solidification of silicon. Methods for the structural and electrical characterization of cast silicon ribbons are assessed as well as silicon ribbon technology for the 1978 to 1986 period. A.R.H.

N78-30656*# Lockheed Missiles and Space Co., Palo Alto, Calif. Material Sciences Lab.
SPRAYLON FLUOROCARBON ENCAPSULATION FOR SILICON SOLAR CELL ARRAYS, PHASE 3 Final Report
L. G. Naes Apr. 1978 50 p
(Contract JPL-954410)
(NASA-CR-157550; LMSC-D626452) Avail: NTIS HC A03/MF A01 CSCL 10A

The liquid transparent film-forming, fluorocarbon, Spraylon, a protective coating for terrestrial solar cell modules was evaluated. Two modules were completed and field tested. Problems developed early in the field testing which led to the shortened test period, specifically, lifting of the antireflection coating, followed in some areas by complete film delamination. It is believed that although these problems were certainly induced by the presence of the SPRAYLON film, they were not failures of the material per se. Instead, assembly procedures, module design, and cell coating quality should be evaluated to determine cause of failure. J.M.S.

N78-30657*# Midwest Research Inst., Minnetonka, Minn.
THE PRODUCTION OF ULTRATHIN POLYIMIDE FILMS FOR THE SOLAR SAIL PROGRAM AND LARGE SPACE STRUCTURES TECHNOLOGY (LSST): A FEASIBILITY STUDY Final Report
R. H. Forester 1978 25 p refs Prepared for JPL
(Contract JPL-954489; MRI Proj. 4437-N)
(NASA-CR-157569) Avail: NTIS HC A02/MF A01 CSCL 10A

Polyimide membranes of a thickness range from under 0.01 micron m to greater than 1 micron m can be produced at an estimated cost of 50 cents per sq m (plus the cost of the polymer). The polymer of interest is dissolved in a solvent which is solube in water. The polymer or casting solution is allowed to flow down an inclined ramp onto a water surface where a pool of floating polymer develops. The solvent dissolves into the water lowering the surface tension of the water on equently, the contact angle of the polymer pool is very low and the edge of the pool is very thin. The solvent dissolves from this thin region too rapidly to be replenished from the bulk of the pool

and a solid polymer film forms. Firm formation is rapid and spontaneous and the film spreads out unaided, many feet from the leading edge of the pool. The driving force for this process is the exothermic solution of the organic solvent from the polymer solution into the water. A.R.H.

N78-30658*# Barry (Theodore) and Associates, Los Angeles, Calif.
SAMICS MARKETING AND DISTRIBUTION MODEL
Apr. 1978 109 p refs Prepared for JPL and DOE
(Contract NAS7-100; JPL-954905)
(NASA-CR-157552; DOE/JPL-954909-78/2) Avail: NTIS HC A06/MF A01 CSCL 10A

A SAMICS (Solar Array Manufacturing Industry Costing Standards) was formulated as a computer simulation model. Given a proper description of the manufacturing technology as input, this model computes the manufacturing price of solar arrays for a broad range of production levels. This report presents a model for computing these marketing and distribution costs, the end point of the model being the loading dock of the final manufacturer. G.Y.

N78-30659*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Electrical Power Systems Dept.
STUDY OF SEP SOLAR ARRAY MODIFICATIONS Final Report
G. J. Antonides 14 Jul. 1978 57 p refs
(Contracts NAS7-100; JPL-995070)
(NASA-CR-157403; LMSC-D573788) Avail: NTIS HC A04/MF A01 CSCL 10A

The feasibility of modifying the solar electric propulsion (SEP) 66 watt/kilogram, 12.5 kilowatt solar array blanket design to incorporate ultra-low mass blanket technology and to generate conceptual design data by modifying the SEP solar array design to 17.5kW power output was performed. Five modified designs were developed, which substituted present SEP solar array design components with one or more of 50 micron thick solar cells, 75 micron cell coverglasses, and a different blanket substrate developed by GE. A parametric analysis was performed to determine the solar array mast least weight and blanket tension required to maintain a minimum natural frequency of 0.04 Hz. The solar array wing assembly weights and power outputs were calculated, and preliminary cost estimates for flight hardware development, fabrication and qualification were made for each case studied. S.E.S.

N78-30660*# IBM Federal Systems Div., Huntsville, Ala.
SIMS PROTOTYPE SYSTEM 3 TEST RESULTS: ENGINEERING ANALYSIS
Aug. 1978 70 p
(Contract NAS8-32036)
(NASA-CR-150758) Avail: NTIS HC A04/MF A01 CSCL 10A

The results obtained during testing of a closed hydronic drain down solar system designed for space and hot water heating is presented. Data analysis is included which documents the system performance and verifies the suitability of SIMS Prototype System 3 for field installation. L.S.

N78-30661*# IBM Federal Systems Div., Huntsville, Ala.
SIMS PROTOTYPE SYSTEM 4: DESIGN DATA BROCHURE
Aug. 1978 89 p refs
(Contract NAS8-32036)
(NASA-CR-150759) Avail: NTIS HC A05/MF A01 CSCL 10A

A pre-package prototype unit having domestic hot water and room solar heating capability that uses air as the collector fluid is described. This system is designed to be used with a small single-family dwelling where a roof mounted collector array is not feasible. The prototype unit is an assemble containing 203 square feet of effective collector surface with 113 cubic feet of rock storage. The design of structure and storage is modular, which permits expansion and reduction of the collector array and storage bed in 68 square feet and 37 cubic feet increments respectively. The system is designed to be transportable. This permitted assemble and certification testing in one area and installation in another area without tear down and reassemble. Design, installation, operation, performance and maintenance of this system are described. G.Y.

N78-30662*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CHARACTERIZATION OF SOLAR CELLS FOR SPACE APPLICATIONS. VOLUME 2: ELECTRICAL CHARACTERISTICS OF SOLAREX 50-MICRON SOLAR CELLS AS A FUNCTION OF INTENSITY AND TEMPERATURE
R. G. Downing, T. F. Miyahira, and R. S. Weiss 15 Aug. 1978 38 p ref
(Contract NAS7-100)
(NASA-CR-157562; JPL-Pub-78-15-Vol-2) Avail: NTIS HC A03/MF A01 CSCL 10A

Electrical characteristics of Solarex 50 micron-thick N/P silicon solar cells are presented in graphical and tabular format as a function of solar illumination intensity and temperature. Author

N78-30663*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SITING ISSUES FOR SOLAR THERMAL POWER PLANTS WITH SMALL COMMUNITY APPLICATIONS
J. J. Holbeck and S. J. Ireland 20 Jul. 1978 49 p refs Sponsored by DOE
(Contract NAS7-100)
(NASA-CR-157559; JPL-Pub-78-75; DOE/JPL-1060-78/2) Avail: NTIS HC A03/MF A01 CSCL 10B

Technologies for solar thermal plants are being developed to provide energy alternatives for the future. Implementation of these plants requires consideration of siting issues as well as power system technology. While many conventional siting considerations are applicable, there is also a set of unique siting issues for solar thermal plants. Early experimental plants will have special siting considerations. The siting issues associated with small, dispersed solar thermal power plants in the 1 to 10 MWe power range for utility/small community applications are considered. Some specific requirements refer to the first 1 MWe engineering experiment for the Small Power Systems Applications (SPSA) Project. The siting issues themselves are discussed in three categories: (1) system resource requirements, (2) environmental effects on the system, and (3) potential impact of the plant on the environment. Within these categories, specific issues are discussed in a qualitative manner. Examples of limiting factors for some issues are taken from studies of other solar systems. S.E.S.

N78-30664# Naval Civil Engineering Lab., Port Hueneme, Calif.
SOLAR HEATING OF BUILDINGS AND DOMESTIC HOT WATER Final Report, Jul. 1974 - Dec. 1975
E. J. Beck, Jr. and R. L. Field Nov. 1977 88 p refs Revised (YF57571999)
(AD-A054601; CEL-TR-835) Avail: NTIS HC A05/MF A01 CSCL 03/2

The purpose of this document is to provide guidance in the design and cost analysis of solar heating systems for buildings and domestic hot water (DHW). The nature of solar radiation, several types of solar systems, storage devices and architectural considerations are among topics included. Calculation methods are included for determining collector size, storage size, simplified building and DHW loads, value of fuel saved, and saving-investment ratios. The calculation procedure is based on parametric curves for 'fraction of heating load supplied by solar energy' and several 'rules of thumb' for design. A series of 11 worksheets is used to enable the engineer with no prior experience with solar systems to accomplish a complete design and cost analysis. With this information he can prepare bidding and specification documents for the job. Tables of solar insolation at various Navy stations, typical building heat loads, collector prices by type, and storage tank prices are included. Two example problems are worked for tube-in-sheet collectors: one for space and DHW heating for a single dwelling, and the other DHW supply for a dispensary. Neither was found to be cost effective when competing against present day prices for natural gas. A directory of manufacturers and bibliography is also included. Author (GRA)

N78-30665# Naval Academy, Annapolis, Md. Energy-Environment Study Group.
DIMENSIONAL ANALYSIS OF OCEAN THERMAL ENERGY

CONVERSION HEAT EXCHANGERS Final Report, 1 Jul. 1976 - 30 Jun. 1977
Martin E. Nelson and Arthur E. Bock 30 Jun. 1977 50 p refs
(AD-A054985; USNA-EPRD-33) Avail: NTIS HC A03/MF A01 CSCL 10/1

This paper points out certain historical highlights and problems connected with development of electrical energy from deep-ocean thermal differences. Natural and economic factors which have focused attention on this type of energy development are mentioned, as well as areas of support by the National Science Foundation, the Energy Research and Development Administration and the U.S. Navy. Dimensional analysis is used to develop a list of dimensionless groups of factors having significance in OTEC (Ocean Thermal Energy Conversion) heat exchangers. Certain of these groups are then evaluated for a model and prototype OTEC-Type heat exchanger using the same working fluid and experiencing the same working fluid flow rate per unit area. A discussion of the evaluation and conclusions complete the report. Author (GRA)

N78-30666# Dayton Univ. Research Inst., Ohio.
FEASIBILITY STUDY OF INORGANIC OXIDES FOR THERMAL ENERGY STORAGE APPLICATIONS Final Rept., 15 Mar. 1976 - 30 Sep. 1977
Joseph E. Davison Nov. 1977 87 p refs
(Contract F33615-76-C-2096)
(AD-A054857; UDRI-TR-77-53; AFAPL-TR-77-70) Avail: NTIS HC A05/MF A01 CSCL 07/2

The University of Dayton conducted a feasibility study of the application of inorganic oxides as the best energy storage media for thermal energy storage devices. The thermophysical properties of the heat of fusion and the melting temperatures of the pure inorganic oxides were reviewed and evaluated. A total of nine inorganic oxides were identified which have a value for the heat of fusion greater than 793.7 Joules per gram (100 watt-hours per pound). However, all of the melting points of these nine oxides are greater than 1570 C. Since none of these pure materials had a melting point in the desired temperature interval of 538 C to 760 C (1000 F to 1400 F), the phase diagrams of binary inorganic oxides were reviewed. The study of binary inorganic oxide systems was limited to those systems which contain at least one of the nine pure oxides which have a liquid-solid transformation in the required temperature interval. The binary system comprised of dilithium oxide and diboron trioxide was assessed as having the highest potential. GRA

N78-30667# Argonne National Lab., Ill.
ADVANCED FUEL CELL DEVELOPMENT Progress Report, Apr. - Jun. 1977
J. P. Ackerman, K. Kinoshita, J. W. Sim, R. Swaroop, and P. A. Nelson Aug. 1977 22 p refs
(Contract W-31-109-eng-38)
(ANL-77-56) Avail: NTIS HC A02/MF A01

Efforts were directed toward understanding and improvement of molten-carbonate-electrolyte fuel cells operating at temperatures near 923 K. A primary focus of the work was on developing electrolyte structures which have high strength and conductivity, as well as good electrolyte retention, and on developing methods of synthesis for electrolyte structures that are amenable to mass production. A low temperature synthesis which produces material having rodlike particles of beta-LiAlO2 was refined and is now used for preparing electrolytes. Cell testing is essential for understanding and evaluating individual component behavior and the interactions of the components under realistic operating conditions. Most of the testing to date was conducted in a 7-cm (2 3/4-in.)-dia cylindrical cell with Type 316 stainless steel housings and current collectors, a nickel anode, and a nickel oxide cathode. ERA

N78-30668# Tennessee Valley Authority, Muscle Shoals, Ala.
EVALUATION OF INTERMEDIATE-Btu COAL GASIFICATION SYSTEMS FOR RETROFITTING POWER PLANTS Final Report
D. A. Waitzman, H. Faucett, D. E. Nichols, S. V. Tomlinson, and W. J. Broadfoot Aug. 1977 126 p refs Sponsored by Electric Power Research Inst.
(EPRI-AF-531) Avail: NTIS HC A07/MF A01

Process and economic evaluations were made of two different intermediate-Btu coal gasification systems retrofitted to an existing electric power unit. One of the systems uses fixed-bed, oxygen-blown Lurgi gasifiers for sized coal (coal fines are sold as a byproduct) with a tar and oil cleanup, hydrogen sulfide removal and sulfur recovery processes. The other system uses entrained-bed gasifiers, which gasify the coal including fines, with a hydrogen sulfide removal and sulfur recovery process. Using a prescribed set of representative power unit, process design and economic premises, a base case (500 MW,3.5% S in coal, existing unit) incorporating the latest available technology was defined for each system, including a complete material balance, equipment list, and construction and operating requirements. Capital investment, annual revenue requirements (7,000 hr/yr) and lifetime revenue requirements (over a 25-yr declining operating profile) were estimated for the base case of each system. ERA

N78-30669# RCA Advanced Technology Labs., Camden, N. J.
TECHNICAL AND ECONOMIC FEASIBILITY OF THERMAL STORAGE Final Report
B. Shelpuk, P. Joy, and M. Crouthamel Jun. 1977 118 p refs
(Contract EY-76-C-02-2591)
(COO/2591-76/1) Avail: NTIS HC A06/MF A01

Various thermal energy storage alternatives were compared for performance and annualized cost which result from each storage alternative operating with the same solar collector model, the same building load model, and the same heating system and controls model. Performance and cost calculations were made on the basis of an hour-by-hour time step using actual weather bureau data for Albuquerque, N. M., and New York City for a single six-month heating season. The primary conclusion is that using current costs for materials and containers, water is the cheapest storage alternative for heating applications in both Albuquerque and New York City. The cost of containing or encapsulating phase change materials, coupled with their small system performance advantage, is the main reason for this conclusion. The use of desicant materials for thermal storage is considered to be impractical due to irreversibilities in thermal cycling. ERA

N78-30670# Oak Ridge National Lab., Tenn.
ALTERNATE OPERATING CONDITIONS AND SYSTEMS FOR THE COAL-FIRED MODULAR INTEGRATED UTILITY SYSTEM
G. Samuels and W. M. Wells Feb. 1978 54 p refs
(Contracts W-7405-eng-26; EX-76-A-01-1742)
(ORNL/HUD/MIUS-46) Avail: NTIS HC A04/MF A01

An analysis is made to determine the effects of varying the operating conditions of a coal-fired, closed-cycle gas turbine modular integrated utility system on the efficiency and cost of the plant and to evaluate the merits of using an organic Rankine system for this application, either as a single cycle or in combination with the gas turbine system. The electrical efficiency and overall fuel utilization of the reference gas turbine plant were severely degraded by reducing the turbine inlet temperature. The electrical efficiency was reduced about two points for each 100 F (56 K) reduction in temperature, with little, if any, change in the the cost of the plant over a temperature range from 1500 to 1200 F (1089 to 922 K). A single cycle organic Rankine system was not well suited for this application and would, at best, be very marginal. The addition of an organic Rankine secondary cycle to the gas turbine system offered the potential for significant improvements in both efficiency and cost over that of the reference gas turbine plant. ERA

N78-30671# Oak Ridge National Lab., Tenn.
RELIABILITY CONSIDERATIONS FOR A COAL-FIRED MODULAR INTEGRATED UTILITY SYSTEM
Garland Samuels Feb. 1978 46 p refs Sponsored in part by HUD
(Contracts W-7405-eng-26; EX-76-A-01-1742; Contract E(49-18)-1742)
(ORNL/HUD/MIUS-45) Avail: NTIS HC A03/MF A01

A statistical analysis is made to estimate the availability and power outage rates for a coal-fired modular integrated utility system composed of four to six parallel power modules in which

there are two modules in excess of those required to meet the system's critical load. The analysis included estimates of the mean time between failure and the mean time to repair for the various subsystems and the effects of several methods of operation on the outage rate. With an operating procedure in which excess capacity when available is on-line, the total plant downtime for a four- to six-module plant was estimated to be in the range of 5 to 10 hr/year. This range of values would be expected only after a shakedown period to debug the system and an extended operating period to establish preventive maintenance procedures. ERA

N78-30672# Oak Ridge National Lab., Tenn. Engineering Technology Div.
INITIAL SIMULATION AND CONTROL SYSTEM STUDIES OF THE MIUS COAL-FIRED TURBINE EXPERIMENT
S. J. Ball Feb. 1978 60 p refs
(Contracts W-7405-eng-26; EX-76-C-01-1742)
(ORNL/HUD/MIUS-42) Avail: NTIS HC A04/MF A01

The dynamic characteristics of the experiment were investigated to determine specific control system designs required to satisfy varying electrical and waste heat demands and, at the same time, to keep plant component temperatures and stresses within acceptable limits. The simulations indicate that the present control system design is capable of handling expected load transients satisfactorily. ERA

N78-30673# Argonne National Lab., Ill.
PROSPECTS FOR OPEN-CYCLE MHD PLANTS
M. Petrick and W. C. Redman 1977 27 p refs Presented at the Am. Inst. of Chem. Engr. Symp. on Alternate Processes for Clean Generation of Electric Power from Coal, New York, 16 Nov. 1977
(Contract W-31-109-eng-38)
(CONF-771102-20) Avail: NTIS HC A03/MF A01

Technical problems to be solved and economic promise vis-a-vis other advanced systems for electrical power generation are assessed. The bases for a reduced environmental impact are explained. Ongoing programs for the development of coal-fired plants are reviewed. ERA

N78-30674# Brookhaven National Lab., Upton, N. Y. Technology Assessment Group.
ENERGY USE IN JAPAN AND THE UNITED STATES
A. Doernberg Aug. 1977 73 p refs
(Contract EY-76-C-02-0016)
(BNL-50713) Avail: NTIS HC A04/MF A01

This comparative study was undertaken to explain in part the per capita differential between the two countries. In the introduction, the ratios of energy per capita and energy per dollar of gross domestic product (GDP) are presented. The exchange rates utilized to convert GDP to a common currency are discussed. Brief sections on the energy supply and electric generation situation in Japan are included for background information, followed by the energy consumption sectors. The industrial sector merits most attention because Japan's industrial capacity is second only to that of the U.S. among industrialized nations, and it is here where an intercountry comparison can reveal possibilities of technology transfer. A gross energy efficiency indicator for all industry (measured as industrial energy use per dollar of GDP originating in industry) is established. ERA

N78-30675# Illinois Univ., Urbana. Survey Research Lab.
PUBLIC REACTIONS TO WIND ENERGY DEVICES Final Report
Oct. 1977 215 p Sponsored in part by DOE
(Grant NSF APR-75-22213)
(NSF/RA-770026) Avail: NTIS HC A10/MF A01

Reactions of the general public toward different types of wind energy devices for generating electric energy were explored. More specifically, the objectives were twofold: to provide substantive information on public acceptance of different types of wind energy devices in different settings; and to furnish a methodological base for more intensive studies of public acceptance of such devices. Personal interviews with statistical random samples of adults in six different parts of the country were conducted, with primary emphasis on rural and smaller urban areas. The locations selected were western Michigan, southeastern Wyoming, western Washington, eastern Rhode Island the Chicago area, and the Sandy Hook Unit of the Gateway National Recreation Area in New Jersey. Those interviewed were questioned on a number of topics, including their attitudes toward their opinions on paying extra for pollution-free sources of energy. In addition, they were shown slides of different wind energy machines in various settings and were asked to indicate their preferences from an aesthetic point of view. ERA

N78-30676# Eltra Corp., Plymouth Meeting, Pa.
DEVELOPMENT OF A LEAD ACID BATTERY SUITABLE FOR ELECTRIC VEHICLE PROPULSION Final Report
W. J. Schlotter 26 Aug. 1977 11104 p refs
(Contract W-31-109-eng-38)
(ANL-K-77-3628-1) Avail: NTIS HC A06/MF A01

Detailed estimates for the capital cost and operating cost of a pilot plant to produce electric vehicle battery plates incorporating expanded metal grids are presented. An additional program to improve lead acid batteries for electric vehicles further is also described. The advanced batteries are expected to incorporate either expanded metal grids and/or composite lead/plastic grids. In addition, these batteries are expected to contain low-density active materials. It is anticipated that those additional developments will result in an advanced battery capable of delivering 45 to 50 watt-hours/kg. ERA

N78-30677# Arkla Industries, Inc., Evansville, Ind.
UNITARY SOLAR HEATING/COOLING SYSTEM PACKAGE DEVELOPMENT Progress Report, 1 Jun. 1977 - 31 Jan. 1978
R. H. Merrick 1978 20 p
(Contract EG-77-C-02-4593)
(COO/4593-1) Avail: NTIS HC A02/MF A01

During this period, a 3 ton residential system hardware package was developed and is operating in an Arkla owned solar house in Evansville. The Arkla tower-cooled WF36 chiller was substituted for the evaporatively cooled chiller under development in the package. The residential software and manufacturing programs are underway. ERA

N78-30678# Department of Energy, Washington, D. C.
GUIDE TO SOLAR ENERGY PROGRAMS
Mar. 1978 72 p
(DOE/ET-0036) Avail: NTIS HC A04/MF A01

The mission and objectives of the U.S. Department of Energy (DOE) are outlined. An overview of DOE's solar energy programs is given, including: (1) the solar thermal power systems program; (2) the photovoltaic systems program; (3) the fuels from biomass program; (4) the ocean thermal systems program; and (5) the wind energy systems program. Also, the environmental and resource assessment program and the satellite power system program are described. Solar energy programs now functioning under the Division of Conservation and Solar Applications are described, including the solar technology transfer program and the thermal applications program. Methods of procurement and guides for proposal preparation and sources of solar energy information and activities supporting the solar energy program are discussed. Author (ERA)

N78-30679# Battelle Columbus Labs., Ohio.
HEAT SOURCE COMPONENT DEVELOPMENT PROGRAM Technical Report, Oct. 1977 - Feb. 1978
Mar. 1978 51 p refs
(Contract W-7405-eng-82-094)
(BMI-X-691) Avail: NTIS HC A04/MF A01

The General Purpose Heat Source (GPHS) is being developed by Los Alamos Scientific Laboratory (LASL) for the Department of Energy (DOE) Division of Nuclear Research and Application (DNRA). The first mission scheduled for the GPHS is the NASA Out-of-Ecliptic Flight in January, 1983. Activities in this task were conducted as follows: (1) documentation of results of the reentry thermal, ablation, and thermal stress analyses of the conceptual designs; (2) identification and completion of modifications to the thermal and ablation models used to determine the performance response of the heat source modules during reentry; (3) initiation of modifications to the thermal stress model used to determine the performance response of heat source modules during reentry; (4) completion and documentation of

the surface chemistry experiments; and (5) initiation and completion of activities in support of LASL to define test plans for the trial design phase of the GPHS development program. ERA

N78-30680# Sheet Metal and Air Conditioning Contractors National Assoc., Vienna Va
FUNDAMENTALS OF SOLAR HEATING Correspondence Course
Jan. 1978 176 p refs
(Contract EG-77-C-01-4038)
(HCP/M4038) Avail: NTIS HC A09/MF A01

This correspondence course contains the following lessons: solar heating and cooling, solar radiation, solar collectors, heat storage, control devices and specialty items, sizing solar system components, operation of solar heating systems, domestic water heating, heating system installation, servicing, and legal responsibilities. Author (ERA)

N78-30681# Sheet Metal and Air Conditioning Contractors National Assoc., Vienna, Va.
STUDY GUIDE FOR FUNDAMENTALS OF SOLAR HEATING. A CORRESPONDENCE COURSE FOR THE AIRCONDITIONING INDUSTRY
Jan. 1978 118 p
(Contract EG-77-C-01-4038)
(HCP/M4038-02) Avail: NTIS HC A06/MF A01

The study guide to accompany the correspondence course (HCP/M4038-01) groups the eleven lessons into four study units. There are review tests and unit examinations, structured for assistance in reviewing the material and in integrating new information with that learned previously. ERA

N78-30682# Stuttgart Univ. (West Germany). Inst. fuer Flugzenugbau.
WIND POWER
Ulrich Huetter 1977 4 p In GERMAN Presented at Energy Policies Forum, Stuttgart, 9-12 May 1977
(AED-Conf-77-139-004) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

A survey is presented of the possibilities to utilize wind power. In the FRG, wind power plants could meet about 70% of the electricity demand (approximately 200 TWh) on the basis of figures of 1973. Interconnected operation between wind power converters and solar energy collectors for supplying remote properties or villages seems particularly promising. ERA

N78-30683# Booz-Allen Applied Research, Inc., Bethesda, Md.
STANDARD CRITERIA FOR THE ECONOMIC EVALUATION OF ALTERNATIVE PIPELINE AND FUEL GAS DEMONSTRATION PLANT DESIGN CONCEPTS Final Task Report
Sep. 1977 42 p
(Contract EX-76-C-01-2343)
(FE-2343-42; Task-042) Avail: NTIS HC A03/MF A01

The recommended procedures for comparative economic evaluations of demonstration plants are primarily that: a base case economic analysis performed in accordance with specified assumptions and procedures, to be part of the proposal is required; and specific economic data elements be provided for use in a computerized economic analysis performed by analysts. This course of action will provide uniformly developed base case analyses which can be used with a high degree of comparability among projects. Moreover, the submission of specified data elements will enable analysts to perform sensitivity studies without significantly increasing the requirements. Recommendations, plus supplemental analyses are presented to provide a sound framework for making economic comparisons between alternative plant design concepts. ERA

N78-30684# Foster Wheeler Corp., Livingston, N.J.
DESIGN REPORT. VOLUME 1: PROCESS DESIGN. DEVELOPMENT WORK FOR AN ADVANCED COAL GASIFICATION SYSTEM FOR ELECTRIC POWER GENERATION FROM COAL DIRECTED TOWARD A COMMERCIAL GASIFICATION GENERATION PLANT, PHASE 2
Oct. 1977 324 p refs
(Contracts EX-76-C-01-1521; E(49-18)-1521)
(FE-1521-20-Vol-1) Avail: NTIS HC A14/MF A01

The status of a design for a pilot plant to gasify 20 t/h of coal in an entrained flow gasifier and produce low-Btu gas for power generation in a combine cycle is summarized. The pilot plant is designed to obtain the technology required to build commercial coal gasification/combined cycle power plants. To minimize problems which might interfere with achievement of these objectives, sections of the pilot plant auxiliary to the gasifier were designed to use available, commercially proven processes and equipment wherever possible. ERA

N78-30685# Oak Ridge National Lab., Tenn. Chemical Technology Div.
SUPPORT RESEARCH AND DEVELOPMENT ON SEPARATIONS TECHNOLOGY Final Report
B. R. Rodgers, S. Katz, and P. R. Westmoreland Oct. 1977 92 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5843) Avail: NTIS HC A05/MF A01

Separations technology was studied for coal conversion systems. Alternative methods for accomplishing the solid liquid separations that are required for liquefaction processes were examined. Phase II, characterization tests of selected process streams and scouting tests for some alternate separations methods were carried out. Bench-scale development of agglomeration settling separations techniques, verification of methods to significantly improve process filtration rates, and selected characterization and aging tests were also surveyed. ERA

N78-30686# Oak Ridge National Lab., Tenn.
STEADY-STATE COMPOSITION PROFILES IN MIXED MOLTEN SALT BATTERY AND FUEL CELL ANALOGS
C. E. Vallet and J. Braunstein 1977 22 p refs Presented at ANS Winter Meeting, San Francisco, 27 Nov. 1977
(Contract W-7405-eng-26)
(CONF-771109-67) Avail: NTIS HC A02/MF A01

Steady state equations were derived for composition gradients in battery and fuel cell analogs with binary mixtures of molten salts as electrolytes. Conditions of current density, electrode separation, electrolyte composition, temperature, ion mobilities and electrode reaction are presented that favor steady state, precipitation of a solid phase, or depletion of an ionic constituent at an electrode. ERA

N78-30687# Oak Ridge National Lab., Tenn.
RESIDENTIAL ENERGY USE TO THE YEAR 2000: A REGIONAL ANALYSIS
E. Hirst and J. B. Kurish Nov. 1977 50 p refs
(Contract W-7405-eng-26)
(ORNL-CON-17) Avail: NTIS HC A03/MF A01

The effects of residential energy conservation programs in each of the ten Federal regions are evaluated. The programs considered are those proposed in the National Energy Plan: appliance efficiency targets; thermal standards for construction of new residences; and weatherization of existing housing units. Implementation of these programs might cut cumulative (1977-2000) national residential energy use by 41 QBtu. Relative energy savings are highest in Regions 7 and 8 (11 and 10% respectively, of their baselines) and smallest in Region 9 (7%). The net economic benefit to the nation's households of these three Federal programs is $21 billion. Benefits exceed costs in each region; the benefit/cost ratio ranges from a low of 1.4 in Region 10 to a high of 2.0 in Region 6. ERA

N78-30688# National Energy Information Center, Washington, D. C.
THE 1977-1978 HEATING SEASON: PROJECTED NATURAL GAS CURTAILMENTS AND POTENTIAL NEEDS FOR ADDITIONAL ALTERNATE FUELS
Nov. 1977 116 p refs Sponsored by DOE
(DOE/EIA-0015) Avail: NTIS HC A06/MF A01

Curtailments of natural gas requirements for end-use customers at the national level during the 1977-1978 heating season (November-March) are projected to be 1.83 trillion cubic feet (Tcf). These projected curtailments are 60 billion cubic feet (Bcf) or 3 percent lower than projections made for the 1976-1977 season with both projections based on assumptions of normal winter weather. Projected gas curtailments at the national level for the 1977-1978 heating season are 155 Bcf lower than the

actual curtailments reported for the 1976-1977 heating season. The higher curtailments last season were influenced by colder-than-normal winter weather that occurred in many states east of the Mississippi River and in the upper Midwest. Reasons for changes in curtailments, projections of curtailments by type of customer, local areas subject to gas curtailments problems, availability of alternate fuels, and estimated magnitude of additional costs of substituting alternate fuels for curtailed gas volumes are given. ERA

N78-30689# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
EFFECT OF ATMOSPHERIC VARIABILITY ON ENERGY UTILIZATION AND CONSERVATION, SUMMARY OF RESEARCH Technical Progress Report, 1 Nov. 1976 - 31 Jul. 1977
E. R. Reiter, B. R. Johnson, B. C. MacDonald, W. L. Somervell, Jr., and A. M. Starr Sep. 1977 71 p refs
(Contract EY-76-S-02-1340)
(COO-1340-55) Avail: NTIS HC A04/MF A01

Various feedback mechanisms between the oceans and the atmosphere were examined. Several of these mechanisms appear to be the cause of the interannual variability of the atmosphere's general circulation and of climatic changes on a time scale of several tens of years. Specifically, a recent cooling-trend in the North Pacific north of 40 N, and sea surface temperature fluctuations with an irregular periodicity of 2 to 4 years superimposed upon this trend were examined. To advance regional long-range forecasting skills January temperature anomalies over the eastern United States were correlated with flow patterns over the U.S. and Canada. The space heating energy consumption model for Greeley, Colorado, for the winter of 1976-77 was within 98.9 percent of actual natural gas consumption for that city. ERA

N78-30690# Argonne National Lab., Ill. Applied Mathematics Div.
ETA: ENERGY TECHNOLOGY ASSESSMENT MODEL USERS' GUIDE
Beverly A. Arnoldy and James D. Favallo Aug. 1977 73 p refs
(Contract W-31-109-eng-38)
(ANL-AMD-TM-318) Avail: NTIS HC A04/MF A01

The general purposes and uses of the energy technology assessment (ETA) model are discussed along with the basic structure and data requirements of this model. A general description of the model and its limitations is presented. A definition of the subscripts, variable names, and the constraint rows is given. The objective function is presented. The constraints, upon which the objective function is minimized, are discussed and algebraically shown. The data input required for operation is described. Finally, in the appendixes, the output and the IBM job control language required to run the ETA model are described. ERA

N78-30691# Oak Ridge National Lab., Tenn.
THE 1975 ENERGY CONDITIONS IN THE SOUTH
P. L. Rice Mar. 1978 253 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6190) Avail: NTIS HC A12/MF A01

Energy supply and demand conditions in the South in 1975 are described along with the differences in production and utilization patterns relative to the United States. Significant changes during the previous three years are noted to provide continuity with the predecessor report, Energy Conditions in the South: 1972. The most important changes are the substantial increase in nuclear generation of electricity, the absolute and relative decline in oil and gas production, and the increase in per capita energy consumption relative to the nation. Each state within the region is described in detail to ascertain important sub-regional differences in energy conditions. The intent is to provide a description rather than an analysis of regional energy patterns, noting variations and emphasizing the comparative advantages of the South. Such a presentation can yield insight into the future role of the region in contributing to the economic growth and welfare of the nation as its natural resource base is depleted and the transition to alternative energy sources is made. ERA

N78-30692# Los Alamos Scientific Lab., N. Mex.
LOS ALAMOS HOT DRY ROCK GEOTHERMAL PROJECT
D. W. Brown and Ronald Pettitt 1977 26 p refs Presented at the Am. Soc. of Civil Engr. Natl. Conv., San Francisco, 17-21 Oct. 1977
(Contract W-7405-eng-36)
(LA-UR-77-2028; Conf-771027-2) Avail: NTIS HC A03/MF A01

The greatest potential for geothermal energy is the almost unlimited energy contained in the vast regions of hot, but essentially impermeable, rock within the first six or seven km of the earth's crust. The Los Alamos Scientific Laboratory is investigating and developing a practical, economical and environmentally acceptable method of extracting this energy. By early 1978, a 10 MW (thermal) heat extraction experiment will be in operation. In the Los Alamos concept, a man-made geothermal reservoir is formed by drilling into a region of suitably hot rock, and then creating within the rock a very large surface for heat transfer by large-scale hydraulic, fracturing techniques. After a circulation loop is formed by drilling a second hole to intersect the fractured region, the heat contained in this reservoir is brought to the surface by the buoyant closed-loop circulation of water. The water is kept liquid throughout the loop by pressurization. ERA

N78-30693# Nevada Bureau of Mines and Geology, Reno.
SUMMARY REPORT OF AVAILABILITY OF GEOTHERMAL DATA FOR POTENTIAL DIRECT HEAT APPLICATION IN NEVADA
D. T. Trexler Sep. 1977 12 p
(Contract EY-76-S-08-0671)
(NVO/0671-1) Avail: NTIS HC A02/MF A01

An assessment of available data on geothermal springs and wells was performed by first ascertaining which agencies both State and Federal maintain files which have water temperatures. The principal files are maintained by the Nevada Bureau of Mines and Geology, U.S. Geological Survey, and Water Resources Center-Desert Research Institute. The State Engineer's office maintains files of driller's logs. Requirements for completing driller's logs under subsection 5 states water temperature will be reported, if thermometer is unavailable an estimated temperature will be given as cold, warm or hot. The second phase of the assessment of available data to determine the quality of the data in each file was performed by inventory of files and by cross-correlating files by cursory examination. An estimate of the number of entries in the Nevada Bureau of Mines and Geology (NBMG) file with inferred temperatures that could be associated with confidence to replace data was also made. ERA

N78-30694# Energy Research and Development Administration, Washington, D. C. Div. of Solar Energy.
ERDA FACILITIES SOLAR DESIGN HANDBOOK
Aug. 1977 178 p refs
(ERDA-77-65) Avail: NTIS HC A09/MF A01

This handbook covers design of solar heating systems for commercial and laboratory buildings at Energy Research and Development Facilities. It includes discussions of solar energy fundamentals, solar heating and cooling technology, systems, and components, as well as a discussion of solar system economics. Quantitative analysis, with generalized design and sizing curves, is presented for solar heating so that collector and other system parameters can be cost economically sized without a computer simulation. Solar system design considerations and guidelines, as well as guidelines for developing subsystem specifications, are presented. Thus, this handbook is both a primer for the solar novice and a reference manual for the solar system designer. ERA

N78-30695# Oak Ridge Y-12 Plant, Tenn.
DEVELOPMENT OF THE BANDWRAP FLYWHEEL
C. E. Knight, Jr., J. J. Kelly, R. L. Huddleston, and R. E. Pollard 1977 20 p refs Presented at the Flywheel Technol. Symp., San Francisco, 5-7 Oct. 1977
(Contract W-7405-eng-26)
(Y/DA-7290; Conf-771053-3) Avail: NTIS HC A02/MF A01

The development of the first test flywheel is discribed. The flywheel design uses a thick rim element and unidirectional fiber composite bands which pass around the rim diameter and across

a metal hub fitted to the drive shaft. The individual bands are meshed together at the hub and function similar to spokes on a wheel. The design is called the 'bandwrap' flywheel. In the development process, conceptual designs were selected for detailed study. After detailed study, the bandwrap design was selected for fabrication and test. After fabrication, the flywheel was spun to 18,000 rpm where where a predicted delamination occurred in the rim. At this speed, the energy stored was 0.25 kwh and the energy density was 10.1 Wh/lb. ERA

N78-30696# Oak Ridge Y-12 Plant, Tenn.
ANALYSIS OF THE DELTAWRAP FLYWHEEL DESIGN
C. E. Knight, Jr. 1977 9 p refs Presented at the Flywheel Technol. Symp., San Francisco, 5-7 Oct. 1977
(Contract W-7405-eng-26)
(Y/DA-7292; Conf-771053-6) Avail: NTIS HC A02/MF A01

An extension of the 'bandwrap' design is discussed. A model and computer program developed calculates the thickness and elastic properties versus position on the overwrap. The thickness is calculated based on coverage per band, number of bands, and band thickness at a given radial coordinate. The elastic properties are derived assuming the overwrap material to be modeled by the properties of an angle ply laminate. The thickness and properties provide input to a finite element model. A linear, elastic finite element analysis provides an estimate of the energy storage potential for this design. The model was two dimensionally axisymmetric and was anlayzed using the ADINA finite element program. ERA

N78-30697# California Univ., Livermore. Lawrence Livermore Lab.
ENERGY AND TECHNOLOGY REVIEW
R. W. Selden, ed., H. D. Shay, ed., R. B. Crawford, ed., K. L. Cummings, ed., and J. T. Staehle, ed. Jun. 1977 35 p
(Contract W-7405-eng-48)
(UCRL-52000-77-6) Avail: NTIS HC A03/MF A01

A pool-type reactor used in research on radiation damage, and a quasi-electric drive vehicle to help reduce petroleum use are described in a review of energy technology. Windpower on Oahu, Hawaii to develop methods of documenting and predicting wind energy in mountainous regions was also studied. B.B.

N78-30698# Sandia Labs., Albuquerque, N. Mex.
SOLAR ENERGY RESEARCH AT SANDIA LABORATORIES WITH UNIQUE HEALTH AND SAFETY PARAMETERS
L. L. Young 1977 40 p refs Presented at the 65th Natl. Safety Congr. Session, Chicago, 18 Oct. 1977
(Contract EY-76-C-04-0789)
(SAND-77-1412C; Conf-771067-1) Avail: NTIS HC A03/MF A01

A general review of major solar energy projects the Polar Total Energy Test Facility, Solar-Powered Irrigation System, photovoltaics research facilities, and the Solar Thermal Test Facility are described. The hazards associated with the reflection and reradiation of concentrated solar energy from solar collection systems are discussed. The radiation hazard to the retina of the eye is considered in particular. ERA

N78-30699# California Univ., Livermore. Lawrence Livermore Lab.
UTILIZATION OF FLYWHEELS FOR THE EVOLUTION OF HIGH-PERFORMANCE ELECTRIC VEHICLES
L. G. OConnell, J. F. Cooper, A. B. Miller, and H. W. Newkirk 19 Oct. 1977 16 p refs
(Contract W-7405-eng-48)
(UCRL-52346) Avail: NTIS HC A02/MF A01

The performance of current and future electric vehicles is examined and compared with that of projected heat engine vehicles. The shortcomings of electric vehicles in the near future are also discussed. It is predicted that the all-electric vehicle, even those utilizing flywheels to meet transient power demands, will not gain wide acceptance in the near future because of degraded performance characteristics. It is indicated that the flywheel always improves performance and range under certain circumstances. Therefore, a hybrid concept that can increase performance in the near future is examined. This type of vehicle is a much-needed transition system to provide an evolutionary change from the heat engine vehicle of today to future electric vehicles with acceptable performance. ERA

N78-30700# California Univ., Livermore. Lawrence Livermore Lab.
INFLATED CYLINDRICAL SOLAR CONCENTRATOR FOR PRODUCING INDUSTRIAL PROCESS HEAT
J. W. Gerich 14 Oct. 1977 23 p refs Sponsored by DOE
(UCID-17612) Avail: NTIS HC A02/MF A01

The use of industrial process heat below 170 C accounts for 5% of this country's total energy consumption. A concentrating solar collector to produce hot water and steam in this temperature range is under development. The collector structure consists mainly of an inflated thin film plastic cylinder that is clear on the upper portion and is an aluminized reflector on the lower portion. The reflector concentrates sunlight on a receiver tube which is jacketed with a heat transfer suppressing, thin film plastic cylinder. Because of its simplicity, it is believed this collector will be cost effective relative to fossil fuels such as oil at $15/bbl. Computer codes were written to analyze the optical and thermal properties of this collector. Results indicate that weekly tilting of the collector provides over 90% of the energy available from continuous tracking. A selective surface on the receiver tube increases the useful energy gain by more than a factor of five at 170 C. ERA

N78-30701# Department of Energy, Washington, D. C.
METHODOLOGICAL ASPECTS OF ESTIMATING THE EFFICIENCY OF UTILIZATION OF FUEL AND ENERGY RESOURCES
R. B. Akhmedov [1977] 17 p refs Transl. into ENGLISH of Report from All-Union Sci. Res. Inst. of Complex Fuel and Energy Probl., State Planning Comm. of the USSR, Moscow, 1977
(DOE-TR-25) Avail: NTIS HC A02/MF A01

The economy of the Soviet Union is developing on the basis of utilization of its own fuel and energy resources (FER). This is an important advantage of the Soviet economy and one of the prerequisites for its stable growth. However, in order to make full use of this advantage, it is necessary to utilize the available FER as efficiently as possible. This means that the actual demand for various types of fuel and energy in all the branches of the national economy must be satisified with minimum total national economic expenditures on the prospecting, extraction, processing, conversion, distribution, and utilization of the energy resources. A methodological basis for planning measures aimed at raising the efficiency of FER utilization and conservation includes the identification and study of existing reserves of FER economy, and technical and economic justification of the sequence, periods, scales, and branch and territorial structure of their realization. Depending on the planning period of a measure, various methods of study were used. Some specific data were used to show calculation methods. Author (ERA)

N78-30702# Energy Research and Development Administration, Washington, D. C.
HYDROTHERMAL ENERGY SYSTEMS FY 1977: ENVIRONMENTAL DEVELOPMENT PLAN (EDP)
R. R. Loose and H. R. Wasson Jun. 1977 92 p
(EDP/G-01(77)) Avail: NTIS HC A05/MF A01

This plan identifies the environmental, health, safety, social, and economic (EH and S) issues which are associated with the development, demonstration, and commercialization of hydrothermal resources and conversion technology, and the ERDA actions required to resolve them. These actions may include the initiation of R and D activities, operations monitoring, baseline characterization studies, or activities leading to the development of EH and S standards and criteria in concert with other responsible agencies. Hydrothermal energy development program; environmental, health, and safety issues; and environmental program are discussed. Titles of the four appendixes are: forecast guide for active geothermal development areas; discussion of environmental issues; environmental research supporting the resolution of environmental issues; and elements of the hydrothermal environmental projects. ERA

N78-30703# Institute for Energy Analysis, Oak Ridge, Tenn.
CAN THE SUN REPLACE URANIUM?
Alvin M. Weinberg Jul. 1977 31 p refs
(ORAU/IEA(M)-77-2) Avail: NTIS HC A03/MF A01

Two asymptotic worlds, one based on solar energy, the other based on nuclear energy, are compared. The total energy demand in each case is 2,000 quads. Although the sun can, in principal, supply this energy, it probably will be very expensive. If the energy were supplied entirely by breeders, the nuclear energy system would pose formidable systems problems--particularly safety and proliferation. It is suggested that in view of these possible difficulties, all options must be kept open. ERA

N78-30704# National Conference of States on Building Codes and Standards, Inc., McLean, Va.
MODEL CODE FOR ENERGY CONSERVATION IN NEW BUILDING CONSTRUCTION
Dec. 1977 86 p refs
(Contract EY-76-C-03-1230)
(SAN/1230-1) Avail: NTIS HC A05/MF A01

A model code for energy conservation in building construction was developed, setting forth the minimum regulations found necessary to mandate such conservation. The code addresses itself to the administration, design criteria, systems elements, controls, service water heating and electrical distribution and use, both for depletable and nondepletable energy sources. The document is intended for use by state and local building officials in the implementation of a statewide energy conservation program. ERA

N78-30705# National Technical Information Service, Springfield, Va.
THERMIONIC ENERGY CONVERSION, VOLUME 1. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1970 - May 1977
William E. Reed Jun. 1978 301 p
(NTIS/PS-78/0590/6) Avail: NTIS HC $28.00/MF $28.00 CSCL 10B

Research on thermionic power generation, power plant design, converter design, and basic research on thermionic materials are cited in the bibliography. Spacecraft applications are included. (This updated bibliography contains 296 abstracts, none of which are new entries to the previous edition). GRA

N78-30706# National Technical Information Service, Springfield, Va.
THERMIONIC ENERGY CONVERSION, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, Jun. 1977 - May 1978
William E. Reed Jun. 1978 67 p Supersedes NTIS/PS-77/0527; NTIS/PS-76/0389; NTIS/PS-75/372
(NTIS/PS-78/0591/4; NTIS/PS-77/0527; NTIS/PS-76/0389; NTIS/PS-75/372; COM-73-11692) Avail: NTIS HC $28.00/MF $28.00 CSCL 10B

A bibliography containing 62 abstracts concerning research on thermionic power generation, power plant design, converter design, and basic research on thermionic materials is presented. GRA

N78-30707# National Bureau of Standards, Washington, D. C. Center for Building Technology.
METHOD OF TESTING, RATING AND ESTIMATING THE SEASONAL PERFORMANCE OF CENTRAL AIR CONDITIONERS AND HEAT PUMPS OPERATING IN THE COOLING MODE Final Report
George E. Kelly and Walter H. Parken, Jr. Apr. 1978 77 p refs Sponsored by DoE
(PB-280107/4; NBSIR-77-1271) Avail: NTIS HC A05/MF A01 CSCL 13A

The National Bureau of Standards has made a study of the part-load and seasonal performance of residential central air conditioners and heat pumps operating in the cooling mode. This document outlines methods for testing and rating these units which account for the variation in performance due to part-load operation and change in outdoor air temperature. A calculation procedure is presented which can be used to estimate the seasonal performance and seasonal cost of operation of residential central-cooling equipment. GRA

N78-30708# General Accounting Office, Washington, D. C. Energy and Minerals Div.
SOLAR DEMONSTRATIONS ON FEDERAL RESIDENCES: BETTER PLANNING AND MANAGEMENT CONTROL NEEDED
14 Apr. 1978 16 p
(PB-279700/9; EMD-78-40) Avail: NTIS HC A02/MF A01 CSCL 10A

This report is a review of an attempt to demonstrate the practical use of solar heating on Federal residences and makes recommendations to avoid a recurrence of problems encountered. GRA

N78-30709# National Inst. of Building Sciences, Washington, D. C.
ENERGY CONSERVATION STANDARDS FOR BUILDINGS: STATUS OF STATES' REGULATORY ACTIVITIES
15 Feb. 1978 32 p
(Contract HUD-H-2822-RG)
(PB-279936/9; HUD/RES-1331) Avail: NTIS HC A03/MF A01 CSCL 10A

A directory of the state executive offices with responsibility for energy conservation and buildings standards under the divisions of: (1) energy policy; (2) Standards Administration; (3) Standards Enforcement; and (4) Building Codes and Standards is reported. GRA

N78-30710# Environmental Law Inst., Washington, D. C.
LEGAL AND INSTITUTIONAL PERSPECTIVES ON SOLAR ENERGY IN COLORADO. A CASE STUDY OF LAND USE AND ENERGY DECISION-MAKING Final Report
Karin H. Hillhouse, Ellen E. Kohler, Richard A. Liroff, and Alan S. Miller Nov. 1977 243 p
(Grant NSF APR-75-18247)
(PB-279994/8; NSF/RA-770336) Avail: NTIS HC A11/MF A01 CSCL 10A

Colorado's institutional and regulatory structure relevant to an emerging energy technology is considered. Topics covered include: (1) an examination of the potential effect of federal jurisdiction over matters relevant to solar utilization; (2) an analysis of a number of Colorado's incentives, proposed and implemented, that might encourage solar applications and build a solar assessment capability into the state's energy planning institutional structure; (3) development of these considerations with specific attention to utility regulations and to land use planning for solar utilization; and (4) an examination of the general appeal of solar systems by exploring energy literature and social and architectural history. GRA

N78-30711# ARI Foundation, Inc., Arlington, Va.
ORGANIZATION OF CERTIFICATION PROGRAM FOR SOLAR COLLECTORS Final Report
G. R. Munger and Robert J. Evans 30 Nov. 1977 99 p
(Contract NBS-7-35734)
(PB-280025/8; NBS/GCR-78/125) Avail: NTIS HC A05/MF A01 CSCL 10A

Proposed documentation is presented for the operation of a solar collector certification program. The documents included are a Equipment Rating Standard, a Certification Program Operational Manual, a Certification Laboratory Contract, and a Manufacturer's License Agreement. Also provided are a typical calendar for the initiation of a program and an estimate of the first annual budget for a certification program. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N78-30712 Florida Univ., Gainesville.
TOWARD STOCHASTIC MODELS FOR AIR POLLUTION Ph.D. Thesis
John Frederick Chadbourne, Jr. 1977 136 p
Avail: Univ. Microfilms Order No. 7810934

Mathematical models to describe air pollution are necessary planning tools in the air quality management process. They provide a means of predicting and controlling pollution. This dissertation investigates the application of pattern recognition techniques to identify quasistationary conditions with respect to both space

and time. An analysis of mesoscale meteorological conditions was used to illustrate how influence parameters can be identified. The multivariate approach developed in this dissertation for identifying similar ozone waveforms is a powerful analytical tool. The method is not restricted to air pollution research, but extensive applications in atmospheric studies are appropriate.
Dissert. Abstr.

N78-30713 Maryland Univ., College Park.
THE GENERATION OF OZONE IN PLUMES FROM LARGE POINT SOURCES Ph.D. Thesis
William Stanton Keifer, II 1977 680 p
Avail: Univ. Microfilms Order No. 7814019

This work involved the measurement of various pollutant and natural species, including SO2, CO, NO, NO2, O3 and hydrocarbons in plumes from a number of major sources using an instrumented airplane and truck. These data, together with meteorological parameters, were used to gain an understanding of the formation of photochemical oxidants (mainly ozone) in those plumes and to assess the impact of these point source plumes on photochemical oxidant levels in Washington, D. C.
Dissert. Abstr.

N78-30714*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE EFFECT OF CHANGES IN SPACE SHUTTLE PARAMETERS ON THE NASA/MSFC MULTILAYER DIFFUSION MODEL PREDICTIONS OF SURFACE HCl CONCENTRATIONS
Marvin E. Glasser (Kearney State College, Nebraska) and Robert D. Rundel Jul. 1978 51 p refs
(NASA-TM-58207) Avail: NTIS HC A04/MF A01 CSCL 13B

A method for formulating these changes into the model input parameters using a preprocessor program run on a programed data processor was implemented. The results indicate that any changes in the input parameters are small enough to be negligible in comparison to meteorological inputs and the limitations of the model and that such changes will not substantially increase the number of meteorological cases for which the model will predict surface hydrogen chloride concentrations exceeding public safety levels. G.Y.

N78-30715*# AeroChem Research Labs., Inc., Princeton, N. J.
ROCKET EXHAUST GROUND CLOUD/ATMOSPHERIC INTERACTIONS Final Report
BaoChuan Hwang and Robert K. Gould Jul. 1978 190 p refs
(Contract NAS1-14504)
(NASA-CR-2978; AeroChem-TP-362) Avail: NTIS HC A09/MF A01 CSCL 13B

An attempt to identify and minimize the uncertainties and potential inaccuracies of the NASA Multilayer Diffusion Model (MDM) is performed using data from selected Titan 3 launches. The study is based on detailed parametric calculations using the MDM code and a comparative study of several other diffusion models, the NASA measurements, and the MDM. The results are discussed and evaluated. In addition, the physical/chemical processes taking place during the rocket cloud rise are analyzed. The exhaust properties and the deluge water effects are evaluated. A time-dependent model for two aerosol coagulations is developed and documented. Calculations using this model for dry deposition during cloud rise are made. A simple model for calculating physical properties such as temperature and air mass entrainment during cloud rise is also developed and incorporated with the aerosol model. Author

N78-30716# Hanford Engineering Development Lab., Richland, Wash.
PROGRAMMABLE AUTOMATIC ALPHA-BETA AIR SAMPLE COUNTER
W. P. Howell 1978 6 p Presented at 11th Symp. on Radiation Instrumentation, San Diego, Calif., 17 Jan. 1978
(Contract EY-76-C-14-2170)
(HEDL-SA-1302; Conf-780110-11) Avail: NTIS HC A02/MF A01

A programmable automatic alpha-beta air sample counter was developed for routine sample counting by operational health physics personnel. The system is composed of an automatic sample changer utilizing a large silicon diode detector, an electronic counting system with energy analysis capability, an automatic data acquisition controller, an interface module, and a teletypewriter with paper tape punch and paper tape reader. The system is operated through the teletypewriter keyboard and the paper tape reader, which are used to instruct the automatic data acquisition controller. Paper tape programs are provided for background counting, Chi square 2 test, and sample counting. Output data are printed by the teletypewriter on standard continuous roll or multifold paper. Data are automatically corrected for background and counter efficiency. ERA

N78-30717# Battelle Pacific Northwest Labs., Richland, Wash.
IMPACT OF INCREASED COAL CONSUMPTION IN THE PACIFIC NORTHWEST
J. B. Burnham, comp. Mar. 1978 327 p refs
(Contract EY-76-C-06-1830)
(BNWL-RAP-21) Avail: NTIS HC A15/MF A01

Environmental, health and socioeconomic impacts to be expected from the increased use of coal were identified. Mitigation strategies that might be used to manage these impacts were investigated. A number of energy issues were identified. Probably the most significant issues in this region are the siting of coal-fired power plants and the tradeoff in water allocation between energy and agriculture. Choices of coal-fired generation sites and water use determine the level of impacts to air, water land, terrestrial and aquatic ecosystems, and human health and socioeconomics. Air quality impacts were studied by incorporating current and projected emission inventories into both short-range and long-range air quality diffusion models. Results indicate that annual average ambient air quality standards will not be exceeded at any of the sites. ERA

N78-30718# Washington State Univ., Pullman. Thermal Energy Lab.
INORGANIC POLLUTANTS FROM PULVERIZED COAL COMBUSTION, A REVIEW
Philip C. Malte Oct. 1977 26 p refs Presented at Fall Meeting of the Western States Section of the Combust. Inst., Palo Alto, Calif., 17 Oct. 1977
(Contract EX-76-C-01-2252)
(USS/CI-77-48; Conf-771015-16) Avail: NTIS HC A03/MF A01

A review of inorganic pollutants in coal classifies them according to affinity with other major inorganic mineral components (sulfides, sulfates, carbonates, etc.) or affinity with the organic coal. The latter elements are B, Br and Ge and, in some coals, Be, Ga, Sb, Ti, U and V. Most elements have a lower concentration in coal than in the surrounding rocks, but a few are more concentrated in the coal (As, Cl, B, and especially Se). During combustion some of the calcium and other alkali metal compounds appear to tie-up a portion of the sulfur in the coal as sulfates (and thus reduce the air pollution by SO2), if the combustion temperature is not too high. Fly ash formation is also discussed and the tendency of the more volatile elements (or their compounds) to be concentrated on the submicron particle sizes. Finally, several elements in the ash are recommended for special attention because of possible toxic effects on terrestrial systems, as a result of air pollution or leaching from ash disposal sites. ERA

N78-30719# Argonne National Lab., Ill.
ENVIRONMENTAL CONTROL STRATEGIES FOR COAL-FIRED PLANTS: A COMPARATIVE EVALUATION
C. D. Livengood, Paul S. Farber, and Samuel H. Wong 1977 9 p refs Presented at the 5th Ann. Energy and Environ. Conf., Cincinnati, 3 Nov. 1977
(Contract W-31-109-eng-38)
(CONF-7710101-6) Avail: NTIS HC A02/MF A01

The implications of environmental control technologies for the coal-to-electricity process are assessed from a detailed engineering and cost point of view. Comparative evaluations of their efficacies were made from a total system viewpoint, taking into account different geographic, environmental, and regulatory constraints. The focus was on control of airborne emissions by presently available technology. The results point out that there are usually several cost-competitive routes to achieving compliance with existing regulations. ERA

N78-30720# Institute for Energy Analysis, Oak Ridge, Tenn.
ATMOSPHERIC CO2 CONSEQUENCES OF HEAVY DEPENDENCE ON COAL
R. M. Rotty Dec. 1977 39 p refs
(Contract EY-76-S-05-033)
(ORAU/IEA-M-77-27) Avail: NTIS HC A03/MF A01

Increases in the atmospheric concentration of CO2 cause concern only when the quantities become large--i.e., several hundred billion tons of additional carbon. The direct contribution from emphasis on coal use through 1985, as called for in the U.S. National Energy Plan, is of minor consequence. On the other hand, if such a policy continues into the next century, or if it serves as a model for major segments of the world, then the quantity of resulting CO2 could have serious consequences early in the next century. Further, if coal is used on a large scale as the base for liquid and/or gaseous synthetic fuels as the oil and natural gas reserves are depleted, the inefficiencies of conversion would serve to increase the CO2 produced per unit of delivered energy and further aggravate the problem. ERA

N78-30721# Iowa State Univ. of Science and Technology, Ames.
SORPTION OF POLLUTANT GASES BY SOILS Progress Report, 1 Dec. 1976 - 30 Nov. 1977
J. M. Bremner Aug. 1977 10 p refs
(Contract EY-76-S-02-2530)
(COO-2530-11) Avail: NTIS HC A02/MF A01

Studies of factors affecting sorption of nitrous oxide by soils showed that nitrate inhibits reduction of N2O to N2 by soil microorganisms and that the inhibitory effect of nitrate on N2O reduction increases markedly with decrease in soil pH. Emission of nitrous oxide was observed during incubation of soils under aerobic conditions. Research to account for the observation showed that N2O is produced during nitrification of ammonium in well aerated soils and indicated that N2O production nitrification of fertilizer nitrogen in soils may be significant in regard to the potential threat of fertilizer-derived N2O to the ozone layer. A gas chromatographic procedure was developed for determination of N2O in air. It is rapid, sensitive, specific and precise, and it permits use of the xenon in air as an internal standard. Techniques were developed for research on sorption of NO and NO2 by soils, and studies of factors affecting NO2 sorption by soils were initiated. ERA

N78-30722# Brookhaven National Lab., Upton, N. Y. Economic Analysis Div.
LONG-TERM ECONOMIC AND ENVIRONMENTAL CONSEQUENCES
David J. Behling, Jr., William Marcuse, Joan Lukachinski, and Robert Dullien Jun. 1977 102 p refs Presented at ORSA/TIMS Meeting, San Francisco, May 1977
(Contract EY-76-C-02-0016)
(BNL-22735; Conf-770526-4) Avail: NTIS HC A06/MF A01

Potential energy economic and environmental impacts that would result from a policy decision to halt any further construction of nuclear power plants were studied. Wherever possible, each modeling group used the same set of model input parameter values to estimate the impacts. The analysis was based on the use of an integrated modeling system the long term interindustry transactions model, the Brookhaven dynamic energy system optimization model, and several groups of interface equations. The model system is first described and then used to estimate four alternative energy economic, and environmental futures. In the Base Case scenario, it was assumed that growth in the nuclear sector will not be constrained by safety or security considerations, so that, when economical, nuclear reactors will build up at reasonable rates, including advanced uranium and breeder reactors, starting in 2000. ERA

N78-30723# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
NATURE AND FORMATION OF NITROGENOUS AIR POLLUTANT EMISSIONS FROM COMBUSTION SYSTEMS Ph.D. Thesis
R. D. Matthews Oct. 1977 239 p refs
(Contract W-7405-eng-48)
(LBL-6850) Avail: NTIS HC A11/MF A01

Many nitrogen-containing species may be emitted from combustion systems. These sources are reviewed. The atmospheric chemistry and toxicology of the nitrogenous air pollutants which were identified in the emissions from combustion systems is reviewed. Combustion generated N-species may be derived either from thermal fixation of N2 or from the use of fuels containing high concentrations of bound nitrogen. Many strategies which decrease emissions of thermal NO adversely affect emissions of fuel-derived NO. The emissions of fuel-derived N-species, especially NO, from catalytic combustors were investigated. Combustion parameters which were varied include equivalence ratio, adiabatic flame temperature, and fuel nitrogen concentration. For direct comparison with fuel rich catalytic combustion, the same species were monitored in the exhaust of a flat flame burner operating under the same conditions. ERA

N78-30724# Royal Netherlands Meteorological Inst., De Bilt.
APPLICATION OF THE GAUSSIAN PLUME MODEL TO THE CALCULATION OF SHORT TERM AVERAGES IN THE RIJNMOND AREA [TOEPASSING VAN HET GAUSSISCH PLUIMMODEL VOOR DE BEREKENING VAN KORTE-TERMIJN GEMIDDELDEN IN HET RIJNMOND-GEBIED]
C. A. Engeldal and F. T. M. Nieuwstadt 1978 66 p refs In DUTCH; ENGLISH summary
(KNMI-WR-78-2) Avail: NTIS HC A04/MF A01

Validation results of the short-term Gaussian plume models in the Rijnmond area for a period of three months are given. Time series of hourly and 24 hourly averaged sulfur dioxide concentrations were calculated and frequency distributions were computed. The measurements of hourly averaged concentrations were available at 31 receptor points, and of 24 hourly averaged concentrations at 96 receptor points. It was found that the time series are poorly simulated (correlation coefficients varying between 0.1 and 0.7). The calculated frequency distributions compare reasonably well with the measured ones. A slight dependence of measured concentrations on temperature was noticed. This might be caused by the dependence of the domestic and greenhouse emissions on temperature. The 90 percentile of the frequency distribution was calculated by multiplying the long-term average concentration with a constant factor. It was found that the results are comparable to those of the calculation with the short-term model. Author (ESA)

N78-30725# National Physical Lab., Teddington (England). Div. of Quantum Metrology.
REMOTE SENSING OF ATMOSPHERIC POLLUTION FROM SPACE
J. E. Harries Apr. 1978 47 p refs
(NPL-QU-44) Avail: NTIS HC A03/MF A01

A brief review is presented of techniques and instruments for remotely sensing pollution in the lowest layers of the earth's atmosphere from an orbiting spacecraft. The associated difficulties and problems including the weakness of pollutant signals; the high intensity of background radiation; scattering and attenuation due to clouds, aerosols and particulate matter; and atmospheric temperature structure anomalies are discussed. Four basic techniques which should be investigated further are discussed. These are laser absorption spectrometer; microwave absorption spectrometer; gas correlation radiometer; and correlation spectrometer. It is concluded that a combination of several sensors may eventually be used in an operational mode and that further studies of these selected areas should be carried out leading to test flights possibly utilizing platforms such as Spacelab and the space shuttle. Author (ESA)

N78-30726# National Technical Information Service, Springfield, Va.
SEWAGE EFFECTS IN MARINE AND ESTUARINE ENVIRONMENTS, VOLUME 1. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1964 - 1976
Robena J. Brown Jun. 1978 242 p
(NTIS-PS-78/0558/3) Avail: NTIS HC $28.00/MF $28.00 CSCL 06F

Investigations of the impact of sewage effluents and sludge on marine and estuarine ecology are cited. Topics cover the effects on marine plants and animals, problems associated with ocean dumping, dispersion studies, water chemistry, and other related topics. (This bibliography contains 236 abstracts, none of which is new to the previous edition.) GRA

N78-30727# National Technical Information Service, Springfield, Va.
SEWAGE EFFECTS IN MARINE AND ESTUARINE ENVIRONMENTS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1977 - May 1978
Robena J. Brown Jun. 1978 57 p Supersedes NTIS/PS-77/0513; NTIS/PS-76/0438; NTIS/PS-75/430; COM-74-11057 (NTIS-PS-78/0559/1; NTIS/PS-77/0513; NTIS/PS-76/0438; NTIS/PS-75/430; COM-74-11057) Avail: NTIS HC $28.00/MF $28.00 CSCL 06F

Topics cover the effects that sewage effluents and sludge have upon marine and estuarine environments, especially their ecology. The effects on marine plants and animals, problems due to ocean dumping, dispersion studies, water quality and other related subjects are included. (This updated bibliography contains 51 abstracts, 26 of which are new entries to the previous edition.) GRA

N78-30728# National Technical Information Service, Springfield, Va.
SALT MARSHES, VOLUME 1. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1964 - 1976
Robena J. Brown Jun. 1978 208 p
(NTIS/PS-78/0533/6) Avail: NTIS HC $28.00/MF $28.00 CSCL 06F

Citations dealing with all aspects of salt marshes are presented. Most topics cover ecology, productivity, pollution effects, and land use effects. (This updated bibliography contains 202 abstracts, none of which is new to the previous edition.) GRA

N78-30729# National Technical Information Service, Springfield, Va.
SALT MARSHES, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1977 - May 1978
Robena J. Brown Jun. 1978 92 p Supersedes NTIS/PS-77/0511; NTIS/PS-76/0439; NTIS/PS-75/426; COM-74-10312 (NTIS/PS-78/0534/4; NTIS/PS-77/0511; NTIS/PS-76/0439; NTIS/PS-75/426; COM-74-10312) Avail: NTIS HC $28.00/MF $28.00 CSCL 06F

This bibliography cites 86 documents relating to all aspects of salt marshes and coastal zone management. Topics cover estuarine ecology, biological productivity, pollution effects, land development, drainage, vegetation, and dredging. (Forty-two of the entries are new to the previous edition.) GRA

N78-30730# Mason and Hanger-Silas Mason Co., Inc., Leonardo, N. J.
PERFORMANCE TESTING OF OIL MOP ZERO RELATIVE VELOCITY OIL SKIMMER Final Report, 29 Nov. - 3 Dec. 1976
Michael K. Breslin Apr. 1978 30 p Sponsored in part by the Coast Guard
(Contract EPA-68-03-0490)
(PB-280232/0; EPA-600/7-78-060) Avail: NTIS HC A03/MF A01 CSCL 13B

A fast current prototype skimmer was designed and built and delivered to the Oil and Hazardous Materials Simulated Environmental Test Tank (OHMSETT) to be tested. The principle of operation was based on absorbing oil onto oleophilic fibers woven into a rope. The rope and fibers were then squeezed by wringers to remove the oil into a recovery basin. The device was rigged, trimmed, and then towed into a controlled oil slick while being operated and monitored for oil recovery. Device operating speed, oil slick thickness, tow speed, and wave conditions served as controlled independent variables. The fluid recovered was sampled during and after the test run to determine device performance. GRA

N78-30731# Alabama Univ., University. Coll. of Engineering.
SITE SELECTION AND DESIGN FOR MINIMIZING POLLUTION FROM UNDERGROUND COAL MINING OPERATIONS Final Report, Jun. 1974 - Dec. 1976
Reynold Q. Shotts, Eric Sterett, and Thomas A. Simpson Jan. 1978 111 p refs
(Contract EPA-68-03-2015)
(PB-280180/1; EPA-600/7-78-006) Avail: NTIS HC A06/MF A01 CSCL 13B

The objectives of how best to select a layout and mining system were examined and also to develop and operate an underground coal mine while at the same time minimizing pollution of the environment. The pre-mining environment was assessed by sampling Cedar Creek 3 and other streams. Analyses of samples of groundwater into the mine, of the water pumped from the mine sump, and of water from Cedar Creek below the mine, made possible the assessment of the area with regard to water quality. Principal factors associated with mining which affected downstream water quality were sulfide oxidation and acid formation in the mine, the quality of the groundwater seeping into the mine, the limestone used for rock dusting, and the quality of the resettled, but not treated mine and washing plant water carried to the continuous miners for dust suppression. Deep mines in Alabama's synclinal coalfields, if entered some distance from the outcrop, or mined down-dip if started on the cutcrop, should produce little surface pollution. GRA

N78-30732# Transportation Systems Center, Cambridge, Mass.
COMPUTER MODELING OF TRANSPORTATION-GENERATED AIR POLLUTION: STATE-OF-THE-ART SURVEY, 2 Final Report, Jul. 1976 - Jun. 1977
Eugene M. Darling, Jr. and Jeffrey D. Garlitz Mar. 1978 179 p refs Prepared in cooperation with Input Output Computer Services, Inc.
(PB-280109/0; DOT-TSC-OST-78-6; DOT-TSC-RSPD-78-1) Avail: NTIS HC A09/MF A01 CSCL 04A

The computer modeling of inert gases, particulates, and reactive pollutants is discussed with emphasis on model types, implementation (i.e., input data, computer requirements, output) applications, model validation and availability. It is concluded that no model in current use has been adequately tested and evaluated. Air quality data near transportation systems are categorized by type of site, dates of data acquisition, funding source, and data availability. GRA

N78-30733# Maryland Univ., College Park. Dept. of Civil Engineering.
ESTIMATES OF NONPOINT SOURCE POLLUTION BY MATHEMATICAL MODELING Completion Report
Richard H. McCuen, Roger C. Sutherland, Robert L. Powell, and Gregory E. Kamadulski Mar. 1978 20 p
(Contract DI-14-34-0001-7044; OWRT Proj. A-030-MD(1))
(PB-280553/9; W78-06405) Avail: NTIS HC A02/MF A01 CSCL 13B

The environmental consequences of the rapid expansion of urban communities into areas that had previously been dominated by rural land use were the cause of increasing concern over the past decade. Techniques for the rational analysis of the environmental quality of the affected region are needed to examine the environmental consequences of existing and future projects in the planning community. A computer simulation model was developed to estimate the accumulation of pollutants in urban subbasins. A model component is also used to estimate the removal of the pollutants for any rainfall avent. The model could be used by planners to estimate the pollution loading from an urban subbasin that enters streams for all or part of that region. GRA

N78-30734# Missouri Univ. - Columbia.
ELIMINATION OF POLLUTANTS BY UTILIZATION OF EGG BREAKING PLANT SHELL-WASTE Final Report
J. M. Vandepopuliere, H. V. Walton, W. Jaynes, and O. J. Cotterill Mar. 1978 47 p refs
(Contract EPA-S-803614)
(PB-280125/6; EPA-600/2-78-044) Avail: NTIS HC A03/MF A01 CSCL 13B

A triple pass rotary drum dehydrator was installed at an egg breaking plant. With appropriate engineering modifications a system for producing egg shell meal from the total egg shell waste from the breaking plant was developed. This meal was utilized as a feedstuff by a local mill and incorporated into a layer diet. This diet was fed to several commercial flocks of cage layers. Appropriate data were collected to determine meal production costs, yield of meal, feed producted, feeding data, and layer flock performance. COD and BOD data were generated to determine the pollution potential of the waste were it not converted to a useful by-product. GRA

N78-30735# Environmental Protection Agency, Washington, D. C. Office of Monitoring and Technical Support.
WATER QUALITY INDICES: A SURVEY OF INDICES USED IN THE UNITED STATES Progress Report, Oct. 1976 - Jun. 1977
Wayne R. Ott Jan. 1978 138 p
(PB-280057/1; EPA-600/4-78-005) Avail: NTIS HC A07/MF A01 CSCL 13B

Water quality indices currently being used in the United States are reviewed to determine: (1) which agencies are using indices, (2) the type of index being used, (3) the purpose of its use, and (4) the attitudes of agency personnel toward indices. One-fifth of the State and interstate agencies were classified as users of water quality indices. Of the 51 State agencies (including the District of Columbia), 10 States (20 percent) were classified as index users. The National Sanitation Foundation index was the most commonly used index, accounting for 7 of the 12 index users. The remaining agencies use Harkins' index or various user-developed indices. GRA

N78-30736# Pacific Northwest Environmental Research Lab., Corvallis, Ore.
THE BIOENVIRONMENTAL IMPACT OF A COAL-FIRED POWER PLANT, COLSTRIP, MONTANA, DECEMBER 1977 Interim Report
Eric M. Preston and Robert A. Lewis Feb. 1978 531 p refs
(PB-280326/0; EPA-600/3-78-021; IR-3) Avail: NTIS HC A23/MF A01 CSCL 13B

The EPA has recognized the need for a rational approach to the incorporation of ecological impact information into power facility siting decisions in the northern great plains. Research funded by the Colstrip, Coal-fired Power Plant Project is a first attempt to generate methods to predict the bioenvironmental effects of air pollution before damage is sustained. Pre-construction documentation of the environmental characteristics of the grassland ecosystem in the vicinity of Colstrip, Montana began in the summer of 1974. Since then, key characteristics of the ecosystem were monitored regularly to detect possible pollution impacts upon plant and animal community structure. In the summer of 1975, field stressing experiments were begun to provide the data necessary to develop dose-response models for SO2 stress on a grassland ecosystem. These experiments involve continuous stressing of one acre grassland plots with measured doses of SO2 during the growing season (usually April through October). Results of the 1975 field season's investigations are summarized in this publication. The six-year project will terminate in 1980 and a final report will be published after data analyses are complete. GRA

N78-30737# Tennessee Univ., Knoxville. Water Resources Research Center.
THE IMPACT OF URBAN STORMWATER ON THE WATER QUALITY STANDARDS OF A REGULATED RESERVOIR
Floyd C. Larson 8 Mar. 1978 178 p refs
(Contracts DI-14-34-0001-6044; DI-14-34-0001-8045; OWRT Proj. A-043-TENN(4))
(PB-280334/4; W78-06362) Avail: NTIS HC A09/MF A01 CSCL 13B

Changes in the water quality of Fort Loudon reservoir (near Knoxville, Tennessee) as a result of stormwater runoff were observed. A transient flow model was used to trace a slug of water for examination of water quality during runoff events. A sampling methodology was developed which allowed graphical predictions of water quality changes in the slug of water as it moved past the city. Water quality parameters obtained were dissolved oxygen, pH, biochemical oxygen demand, conductivity, temperature, total solids and fecal coliforms. No significant water quality changes were observed between control values and those obtained after the addition of stormwater runoff in the reservoir. GRA

N78-30738# Acurex Corp., Mountain View, Calif. Aerotherm Div.
SOURCE ASSESSMENT SAMPLING SUBSYSTEM: DESIGN AND DEVELOPMENT Final Report, Mar. 1976 - Dec. 1977
D. E. Blake Feb. 1978 207 p refs
(Contract EPA-68-02-2153)
(PB-279757/9; EPA-600/7-78-018) Avail: NTIS HC A10/MF A01 CSCL 14B

The report chronologically describes the design and development of the Source Assessment Sampling System (SASS). The SASS train is the principal sampling element for ducted sources when performing EPA's Level 1 environmental assessment studies. As such, it samples process streams and separates the samples into filterable particulate (four size fractions), organic vapors, and inorganic vapors. The design concept and philosophy are discussed, as well as the evolutionary development of the system. Developmental testing, problem areas, and subsequent system changes are described in detail. A complete description of the calibration procedures and system used to determine the size cut points of the particulate fractionating cyclones used is included. GRA

N78-30371# Postal Service, Washington, D. C. Transportation Div.
AUTOMOTIVE EMISSIONS
T. A. Norman *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 516-524 refs (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30372# Johnson Matthey Chemicals Ltd., London (England).
DEVELOPMENT OF CATALYSTS FOR EXHAUST EMISSION CONTROL
R. A. Searles *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 524-539 refs (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30373# Daimler-Benz, A.G., Stuttgart (West Germany).
EMISSION CONTROL OF V-ENGINES WITH OXYGEN SENSORS
H. D. Schuster *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 540-552 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30374# Volkswagen A.G., Wolfsburg (West Germany).
CRITICAL SURVEY OF TEST PROCEDURES FOR AUTOMOTIVE EMISSIONS
H. Klingenber *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 553-566 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30375# Institut Francais du Petrole, Rueil-Malmaison.
DIESEL EXHAUST ODOR MEASUREMENTS
P. H. Degobert *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 566-581 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30376# Technischer Uerberwachungs-Verein Rheinland, e.V., Cologne (West Germany).
EXHAUST GAS EMISSION FACTORS IN THE MOTOR TRAFFIC FIELD: THEIR IMPACT ON AIR POLLUTION CONTROL
E. Plassmann *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 581-598 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30377# Billings Energy Research Corp., Provo, Utah.
HYDROGEN ENGINE NOx CONTROL BY WATER INDUCTION
R. L. Wooley *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 598-608 (For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

N78-30378# Miami Univ., Fla.
THE EFFECT OF METHANOL ADDITION TO GASOLINE ON TOTAL AND INDIVIDUAL HYDROCARBONS, METHANOL, AND FORMALDEHYDE EMISSIONS FROM A CARBURETTED SPARK IGNITION ENGINE
R. D. Doepker *In* NATO Proc. of the 4th Intern. Symp. on

Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 608-609
(For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N78-30739 California Univ., Berkeley.
CALCULATIONS OF HYDROTHERMAL METASOMATISM AND ORE DEPOSITION IN SUBMARINE VOLCANIC ROCKS WITH SPECIAL REFERENCE TO THE WEST SHASTA DISTRICT, CALIFORNIA Ph.D. Thesis
Mark Hudson Reed 1977 207 p
Avail: Univ. Microfilms Order No. 7812745

Some of the significant results and conclusions from the calculations are the following: (1) as basalt is titrated into seawater and equilibrated at 300 C, part of the sequence of mineral appearance: chlorite, quartz, epidote, paragonite, albite. (2) During seawater-basalt reaction, sulfate is reduced to sulfide by oxidation of ferrous to ferric iron that appears in epidote and hematite. (3) Cooling of the hydrothermal solution along various paths invovling solid phase fractionation does not result in significant separation of silica from metals except when the initial solution is deficient is sulfide. (4) The solution derived from seawater-basalt reaction, when reacted with rhyolite, results in an alteration mineralogy that is nearly the same as what is observed in the West Shasta District. Dissert. Abstr.

N78-30740 Johns Hopkins Univ., Baltimore, Md.
VULCANISM, STRUCTURE, AND PETROLOGY OF LONG VALLEY CALDERA, CALIFORNIA Ph.D. Thesis
Roy Alden Bailey 1978 154 p
Avail: Univ. Microfilms Order No. 7811759

Long Valley caldera is a 17 by 32 km elliptical depression on the east front of the Sierra Nevada, that formed 0.7 m.y. ago during eruption of the Bishop Tuff, an extensive rhyolitic ash fall and ash flow deposit representing the uppermost part (600 cu km) of a large silicic magma chamber. Precaldera volcanism began 3.2 m.y. ago and included eruption of trachybasaltic-andesitic lavas from many small widely scattered centers and the local accumulation of quartz latite lavas, but no volcanic complex of intermediate composition developed as a precursor to the caldera-forming episode. The first rhyolitic eruptions from a probable early-stage of the Long Valley magma chamber began about 1.9 m.y. ago and resulted in the growth of Glass Mountain, a large complex of rhyolite domes and flows, the southwest half of which subsequently collapsed into the caldera during its formation. Dissert. Abstr.

N78-30741 Purdue Univ., Lafayette, Ind.
CORRELATION OF GRAVITY AND MAGNETIC DATA OVER THE GREAT LAKES REGION, NORTH AMERICA Ph.D. Thesis
Val William Chandler 1977 206 p
Avail: Univ. Microfilms Order No. 7813037

Improved correlation techniques emphasizing quantitative approaches were developed, tested, and applied to data sets over the Midcontinental area of North America in order to investigate the upper crustal geology. The two analytical techniques of correlation are referred to as internal correspondence analysis and cluster analysis. Principle attention is given to internal correspondence analysis which involves Poisson's theorem in a moving-window linear regression analysis performed between the anomalous magnetic data reduced to the pole and the first sets of vertical derivative of the gravity anomaly. Cluster analysis is a general pattern recognition technique involving the classification of a data set into groups of similarity. The similarity is based on quantitative comparison of measured or derived attributes. In this approach the gravity and magnetic data are divided into subareas and treated as analyses were individual samples in a cluster routine. Dissert. Abstr.

N78-30742 California Univ., Berkeley.
EXTRUSION OF YULE MARBLE Ph.D. Thesis
Jesse Paul Shore 1977 157 p
Avail: Univ. Microfilms Order No. 78-12773

An extrusion assembly was developed to study the behavior of rocks deformed to large strains during flow by steady state creep. The assembly fits within the pressure cylinder of a Griggs' hot-creep tester and was used successfully to extrude Yule marble at elevated temperatures through a conical die against a back pressure. The upper undeformed section of the specimen grades downwards into the region of plastically deformed grains in the tapered region of the die. Grains along the extrusion axis are elongated and thinned until ratios of length to width of some grains exceed 30:1. Grains along the walls of the die tend to be smaller in size and have a higher density of twin lamellae than grains along the axis. Preferred orientation of grains from X-ray data seems to indicate a concentration of c-axis at a high angle to the extrusion axis. Dissert. Abstr.

N78-30743 Alaska Univ., College.
POSITIVE AND NEGATIVE-ION CHEMISTRY OF THE D-REGION INCORPORATING ENHANCED WATER VAPOR AND SUBMICRON DUST Ph.D. Thesis
Henry Puryear Cole, Jr. 1977 325 p
Avail: Univ. Microfilms Order No. 7814235

A steady state ion-kinetic model of D-region chemistry which is devised to explain various experimentally observed chemical features from an altitude of 60 to 90 km in the upper atmosphere is presented. A computational scheme is developed to manage the 31 nonlinear continuity equations which is shown to be convergent from 80 through 65 km, and possibly lower. The inclusion of dust in the ion-kinetic calculations as an attachment sink for electrons or positive ions considerably increases the effective recombination coefficient when dust concentrations are high (10-100/cu cm) provided the electron density is low (less than 200/cu cm). The coating of the dust particles with ice increases the recombination coefficient by a factor of 100 at the 70-80 km level. A model of water vapor diffusion in the mesophere leads to enhanced values when vertical drift of the neutral atmosphere is included. Dissert. Abstr.

N78-30744 California Univ., Berkeley.
PLATE MOTIONS AND POLAR WANDERING Ph.D. Thesis
Steven Richard Dickman 1977 143 p
Avail: Univ. Microfilms Order No. 7812538

The possibility that the secular polar motion is an observational artifact of the continental drift of the ILS stations is directly examined by consideration of several absolute plate velocity models. Corrections to the ILS data due to the stations motion fail by an order of magnitude to explain the ILS trend: even by taking into account possible plate hyperactivity and non rigidity, the corrections could explain no more than about 30% of the trend. Consequently, the rotation pole is undergoing significant motion of its own relative to the earth's surface. The shift in the pole of figure, associated with the ILS trend, is conceivably a consequence of the redistribution of mass which results from plate motions. The major change in lithospheric density occurs at the continental margins because of the difference between continental and oceanic structure. Using the same absolute plate velocity models employed in the observational correction to the ILS data, the change in the inertia tensor due to one million years of plate motions was computed; both the polar shift and the change in the length of day are found to be negligibly small. It is concluded that the continental drift can in no way explain the secular polar motion of the ILS data; neither observational nor dynamic effects contribute significantly to the observed polar trend. Dissert. Abstr.

N78-30745 Utah Univ., Salt Lake City.
THREE DIMENSIONAL MODELLING OF ELECTRIC AND ELECTROMAGNETIC DATA USING THE FINITE ELEMENT METHOD Ph.D. Thesis
Donald Francis Pridmore 1978 268 p
Avail: Univ. Microfilms Order No. 78-11807

An investigation into two different aspects of electrical and electromagnetic exploration: the presentation and interpretation of the results from a broadband, multifrequency electromagnetic

survey over a massive sulfide prospect; and an investigation into the application of the Finite Element method for the modelling of electric and electromagnetic data in three dimension are presented. The results of measurements of the tilt angle and ellipticity of the polarization ellipse of magnetic field, made at fourteen frequencies in the range 10.5 hz to 86 hz, over a massive sulfide prospect in the foothills copper belt of California are presented. A comparison is made of the results obtained using the vertical axial, moving vertical axial, vertical rotating and horizontal transmitter configuration. Dissert. Abstr.

N78-30746 California Univ., Berkeley.
MICROSEISMS IN GEOTHERMAL EXPLORATION: STUDIES IN GRASS VALLEY, NEVADA Ph.D. Thesis
Alfred Liang-Chi Liaw 1977 188 p
Avail: Univ. Microfilms Order No. 78-12658

Frequency-wavenumber (f-k) spectra of seismic noise measured at several places in Grass Valley, Nevada, exhibited numerous features which were correlated with variations in surface geology and sources associated with hot spring activity. Exploration techniques for geothermal reservoirs, based upon the spatial distribution of the amplitude and frequency characteristics of short-period seismic noise, were applied and evaluated. A detailed investigation of the spatial and temporal characteristics of the noise field was made to guide subsequent data acquisition and processing. A small two-dimensional array was placed at 16 locations in the region to map propagation parameters. The f-k spectra reveal local shallow sources, but no evidence for a significant body wave component in the noise field was found. With proper data sampling, array processing provides a powerful method for mapping the horizontal component of the vector phase velocity of the noise field. Dissert. Abstr.

N78-30747 Minnesota Univ., Minneapolis.
THE PHASE P'dP' AS A MEANS FOR DETERMINING UPPER MANTLE STRUCTURE Ph.D. Thesis
Phyllis Ann Sobel 1978 142 p
Avail: Univ. Microfilms Order No. 7813458

Regional differences in upper mantle discontinuities were determined three continental and four oceanic regions by the use of the seismic phase P'dP', which reflects from the underside of discontinuities at depth d in the mantle. The phase p'p' and its precursors P'dP' were examined at the arrays LASA and NORSAR at five WWSSN stations in India and Pakistan for reflections under Africa, Antarctica, western South Africa and the adjoining Pacific Ocean basin, the Atlantic-Indian basin, the east Indian Ocean, and the south Indian basin. Dissert. Abstr.

N78-30748*# Hughes Aircraft Co., Culver City, Calif.
GEOSYNCHRONOUS MICROWAVE ATMOSPHERIC SOUNDING RADIOMETER (MASR) FEASIBILITY STUDIES. VOLUME 1: MANAGEMENT SUMMARY
Jan. 1978 55 p
(Contracts NAS5-24082; NAS5-24087)
(NASA-CR-156804; HAC-D8647/D9236-Vol-1; SCG-70531R-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 04A

The mission of the microwave atmospheric sounding radiometer (MASR) is to collect data to aid in the observation and prediction of severe storms. The geosynchronous orbit allows the continuous atmospheric measurement needed to resolve mesoscale dynamics. The instrument may operate in conjunction with this document, Volume 1 - Management, which summarizes the highlights of final reports on both the radiometer instrument and antenna studies. The radiometer instrument summary includes a synopsis of Volume 2 - Radiometer Receiver Feasibility, including design, recommended configuration, performance estimates, and weight and power estimates. The summary of the antenna study includes a synopsis of Volume 3 - Antenna Feasibility, including preliminary design tradeoffs, performance of selected design, and details of the mechanical/thermal design. G.Y.

N78-30749*# Hughes Aircraft Co., Culver City, Calif.
GEOSYNCHRONOUS MICROWAVE ATMOSPHERIC SOUNDING RADIOMETER (MASR) FEASIBILITY STUDY. VOLUME 2: RADIOMETER RECEIVER FEASIBILITY Final Report
F. E. Goodwin, M. S. Hersman, and M. Luming Jan. 1978 214 p refs
(Contract NAS5-24082)
(NASA-CR-156805; HAC-Ref-D8647-Vol-2; SCG-70532R-Vol-2) Avail: NTIS HC A10/MF A01 CSCL 04A

For abstract, see N78-30748.

N78-30750*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
UPPER ATMOSPHERE RESEARCH SATELLITE PROGRAM Final Report
W. T. Huntress, Jr. 15 Jul. 1978 62 p refs
(Contract NAS7-100)
(NASA-CR-157558; JPL-Pub-78-54) Avail: NTIS HC A04/MF A01 CSCL 04A

A satellite program to conduct research on the chemistry, energetics, and dynamics of the upper atmosphere was developed. The scientific goals of the Upper Atmospheric Research Program, the program requirements, and the approach toward meeting those requirements are outlined. An initial series of two overlapping spacecraft missions is described. Both spacecraft are launched and recovered by the STS, one in the winter of 1983 at a 56 deg inclination, and the other a year later at a 70 deg inclination. The duration of each mission is 18 months, and each carries instruments to make global measurements of the temperature, winds, composition, irradation, and radiance in the stratosphere, mesosphere, and lower thermosphere between the tropopause and 120 km altitude. The program requires a dedicated ground-based data system and a science team organization that leads to a strong interaction between the experiments and theory. The program includes supportive observations from other platforms such as rockets, balloons, and the Spacelab. S.B.S.

N78-30751# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
APPLICATION OF A NUMERICAL METHOD TO CALCULATE ATMOSPHERIC INFRARED RADIATION FLUX [APLICACAO DE UM METODO NUMERICO PARA O CALCULO DE RADIACAO INFRAVERMELHA NA ATMOSFERA]
Getulio S. S. Nunes and Y. Viswanadham Jul. 1978 38 p refs In PORTUGUESE; ENGLISH summary
(INPE-1303-PE/147) Avail: NTIS HC A03/MF A01

Results of the applicaiton of a numerical scheme for calculating the atmospheric infrared radiation flux and atmospheric cooling rates are presented. Water vapor flux emissivity data are used in the numerical method. The results are in agreement with those obtained using other techniques. A number of example of meteorological interest are worked out to illustrate the versatility and short-time consumption of the computation scheme. Therefore, the method might be used to evaluate infrared flux and flux divergence in problems involving a large amount of atmospheric data. G.Y.

N78-30752# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
OBSERVATIONS OF THE OI 6300 A AND 5577 A NIGHTGLOW CACHOEIRA PAULISTA, BRAZIL DURING THE ASHAY
Y. Sahai, H. Takahashi, and N. R. Teixeira May 1978 26 p refs Proposed for presentation at ASHAY meeting of 1978, Alpbach, Austria.
(INPE-1254-PE/131) Avail: NTIS HC A03/MF A01

Regular measurements of the OI 6300A and 5577A nightglow, using a tilting filter zenith photometer, were carried out during 1976 to 1977. The results for the period March 1976 to July 1977 are discussed. The observed seasonal and diurnal variations of these emissions were similar to other low-latitude stations. No anomalous behavior of these emissions in this region of the Brazilian magnetic anomaly was found. The diurnal variations of the OI 5577A emission in general showed post-midnight enhancements, but had a strong seasonal dependence with larger enhancements during the winter months. G.G.

N78-30753# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
VARIOUS MEASUREMENTS OF ATMOSPHERIC PARAMETERS FROM INCOHERENT SCATTERING OF NIGHTGLOW [MEDIDAS DE VARIACOES DE PARAMETROS DA

ATMOSFERA NEUTRA A PARTIR DE MEDIDAS DE ESPALHAMENTO INCOERENTE E DE LUMINESCENCIA NOTURNA]

Jose Humberto Andrade Sobral Jul. 1977 15 p refs In PORTUGUESE Submitted for publication

(INPE-1059-PE/063) Avail: NTIS HC A02/MF A01

A comparison of theoretical and practical results of integrated 300A luminescence show significant variations in the composition of neutral atmospheric constituents. These variations were detected during the occurrence of large ionizing perturbations of the atmosphere. The red emission was calculated from electron density data collected by radar. Transl. by F.O.S.

N78-30754*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

LATERAL DENSITY ANOMALIES AND THE EARTH'S GRAVITATIONAL FIELD

Barbara E. Lowrey May 1978 51 p refs Submitted for publication

(NASA Order S-40040-B)

(NASA-TM-79554) Avail: NTIS HC A04/MF A01 CSCL 08N

The interpretation of gravity is valuable for understanding lithospheric plate motion and mantle convection. Postulated models of anomalous mass distributions in the earth and the observed geopotential as expressed in the spherical harmonic expansion are compared. In particular, models of the anomalous density as a function of radius are found which can closely match the average magnitude of the spherical harmonic coefficients of a degree. These models include: (1) a two-component model consisting of an anomalous layer at 200 km depth (below the earth's surface) and at 1500 km depth (2) a two-component model where the upper component is distributed in the region between 1000 and 2800 km depth, and(3) a model with density anomalies which continuously increase with depth more than an order of magnitude. S.E.S.

N78-30755*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DETERMINING CRUSTAL STRAIN RATES WITH SPACE-BORNE GEODYNAMICS RANGING SYSTEM DATA. 1: BASELINE ANALYSIS

Steven C. Cohen and Glenn R. Cook Jun. 1978 28 p refs

(NASA-TM-79565) Avail: NTIS HC A03/MF A01 CSCL 08G

A satellite-borne laser ranging system is proposed that is capable of making highly precise geodetic measurements over baselines ranging from a few tens of kilometers to several hundred kilometers. The precision with which crustal strain rates are derived from measurements made with this system is analyzed by using simple site configurations, intersite distances of about 25-70 kilometers, and measurement programs ranging from a few years to fifteen years. It is concluded that precisions of several parts in 10 to the 9th power per year are achievable. Compared to the expected shear strain rates of about 7 x 10 to the minus 7th power yr/1, this produces very favorable signal-to-noise ratios. G.G.

N78-30756*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ALBEDO ENHANCEMENT AND PERTURBATION OF RADIATION BALANCE DUE TO STRATOSPHERIC AEROSOLS

Harshvardhan Jun. 1978 61 p refs

(Contract NASw-2567)

(NASA-TM-79573) Avail: NTIS HC A04/MF A01 CSCL 04A

The effect of stratospheric aerosols on the earth's monthly zonal radiation balance is investigated using a model layer consisting of 75% H2SO4, which is the primary constituent of the background aerosol layer. The reduction in solar energy absorbed by the earth-atmosphere system is determined through the albedo sensitivity, defined here as the change in albedo per unit mid-visible optical depth of the aerosol layer. The optically thin approximation is used in conjunction with the Henyey-Greenstein phase function for scattering to simplify computations. Satellite derived planetary albedos are used as the frame of reference about which the change in albedo is computed. An infrared radiative transfer model is used to estimate the increased greenhouse effect attributed to the aerosol layer. The infrared heating tends to compensate for the albedo effect in altering the radiation balance. The results indicate that the dominant influence of the thin model stratospheric aerosol layer is an increased reflection of solar energy all over the globe except for the polar-winter region, but the change in the radiation balance is seen to be uniform and small equatorwards of 50%. G.G.

N78-30757*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ANALYSIS OF DAILY LATITUDE VARIATIONS

Michael A. Graber Jul. 1978 19 p refs

(NASA-TM-79585) Avail: NTIS HC A02/MF A01 CSCL 04A

The daily latitude measurements of the International polar motion service are analyzed. The results indicate that the annual polar oscillation is probably due to local phenomena with amplitudes varying from 0.05 to 0.15 min. Within the resolution of the residuals (150 cm), there is no indication of the sharp changes which might be associated with earthquake effects. Then, applying Schuster's test to a periodogram of the residuals indicates that there are probably several processes occurring at amplitudes between 0.007 and 0.03 min whose solution awaits a more precise measurement technique. Author

N78-30758*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DIRECT MEASUREMENTS OF THE POLARIZATION OF TERRESTRIAL KILOMETRIC RADIATION FROM VOYAGERS 1 AND 2

M. L. Kaiser, J. K. Alexander, A. C. Riddle (Colorado Univ., Boulder), J. B. Pearce (Colorado Univ., Boulder), and J. W. Warwick (Colorado Univ., Boulder) Jul. 1978 16 p refs

(NASA-TM-79602) Avail: NTIS HC A02/MF A01 CSCL 20N

Terrestrial radiation measurements obtained with planetary radio astronomy experiments on Voyager-1 and 2 during the early portions of each flight show the signals to be predominantly left-hand circularly polarized. Since these emissions were most probably generated above the Northern Hemisphere auroral zone, it is concluded that the radiation is emitted primarily in the extraordinary mode. G.G.

N78-30759# Clarkson Coll. of Technology, Potsdam, N.Y.

COMPARISON OF SOIL MODULI OBTAINED FROM NON-DESTRUCTIVE DYNAMIC TESTING AND CONSTITUTIVE EQUATIONS Final Report, Jun. 1977 - Mar. 1978

William H. Highter Mar. 1978 42 p refs

(Grant AF-AFOSR-3364-77)

(AD-A054597) Avail: NTIS HC A03/MF A01 CSCL 08/15

This report describes an effort to determine the degree of agreement between moduli of airfield granular base materials as measured by a nondestructive (vibratory) pavement evaluation procedure and as predicted from constitutive equations that relate moduli to states of stress induced in the granular material by aircraft loading. The results indicated that for the tensile state of stress that is induced by heavy aircraft loads, Young's modulus of the granular materials considered in the study was approximately inversely proportional to the square root of the state of stress. This could be postulated from the knowledge that for compressive state of stress, Young's modulus is approximately directly proportional to the square root of the state of stress. It was concluded that the moduli of the pavement granular base materials studied which were measured in the field in the Air Force non-destructive pavement evaluation procedure and then reduced to account for low strain levels are in agreement with the moduli determined from empirical constitutive equations. Author (GRA)

N78-30760# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.

PHYSICS OF HEAVY IONS IN THE MAGNETOSPHERE Interim Report

J. M. Cornwall (Calif. Univ.) and Michael Schulz Mar. 1978 93 p refs

(Contract F04701-77-C-0078)

(AD-A054617; TR-0078(3960-05)-6) Avail: NTIS HC A05/MF A01 CSCL 04/1

Magnetospheric ions heavier than protons are important as test-particle probes of magnetospheric dynamical processes, but they are at least equally important for the major roles that they (notably He(+), He(++), and O(+) ions) play as active participants

in natural phenomena. Studies of He(+) and He(++) ions of energy E = 100 keV yield quantitative information about the mechanisms responsible for magnetospheric radial diffusion. Helium ions at lower energies serve as test particles to distinguish between ionospheric sources and solar sources of magnetospheric plasma. GRA

N78-30761# Avco-Everett Research Lab., Everett, Mass.
TURBULENCE ENVIRONMENT CHARACTERIZATION Interim Report, 15 Mar. - 30 Sep. 1977
M. G. Miller and P. L. Zieske Apr. 1978 38 p refs
(Contract F30602-76-C-0054; ARPA Order 2646)
(AD-A054951; RADC-TR-78-72) Avail: NTIS HC A03/MF A01 CSCL 17/8

This report presents discussions of a variety of activities and results relative to the characterization of atmospheric turbulence and its effects on optical propagation. Data was obtained with the Seeing Monitor, Star Sensor, microthermal probes and/or acoustic sounder on more than twenty occasions during the period. Much of this data was of a simultaneous nature. A detailed comparative analysis of the data has not yet been completed. Twenty-one nights of Seeing Monitor data yielded values of r sub o in the range from 4.7 cm to 15.9 cm with an average of 9.8 cm. Thirteen nights of microthermal data yielded values of (C sub n) squared in the range from 4.0 x 10 to the -16th power to 3.9 x 10 to the -14th power with an average of 6.2 x 10 to the -15th power. Twelve nights of Star Sensor data yielded values of the log-amplitude variance in the range from .0003 to .00072 with an average of .00051. GRA

N78-30762# Denver Univ., Colo. Dept. of Physics.
STRATOSPHERIC MEASUREMENTS
Robert C. Amme, Frank H. Murcray, David G. Murcray, John R. Olson, and Walter J. Williams Apr. 1978 81 p refs
(Contract DAAD05-74-C-0795)
(AD-A054898; AD-E430029; ARBRL-CR-00371) Avail: NTIS HC A05/MF A01 CSCL 04/1

The objective of this contract was to obtain stratospheric data concerning the distribution of neutral constituents and ions by a series of balloon flights. The program logically separates into two distinct studies since two different balloon-borne instruments are used to obtain the data. Data concerning the neutral constituents are obtained by means of a liquid helium-cooled grating spectrometer system which measures the atmospheric emission as a function of altitude as the balloon ascends. Data concerning the charged species are obtained by means of a balloon-borne quadrupole mass spectrometer system which samples and identifies ambient ions at float altitude or as the balloon descends. The two distinct measurement techniques and hence flight programs are discussed in separate sections of this review, each one complete on its own.
Author (GRA)

N78-30763# Sandia Labs., Albuquerque, N. Mex.
THERMOELASTIC CAPABILITIES FOR THE SANDIA-BMINES PROGRAM
J. R. Tillerson and M. M. Madsen Feb. 1978 82 p refs
(Contract EY-76-C-04-0789)
(SAND-77-0378) Avail: NTIS HC A05/MF A01

The capability for simulating the thermoelastic behavior of geologic media was added to the SANDIA-BMINES finite element code. The equations governing the response of a continuum to a known temperature field are delineated. In addition, the specifics of the implementation of the continuum equations into the existing finite element program are described. Finally, the results of validation studies performed to assess the accuracy of the modified program are presented along with recommendations concerning future research and development efforts in this field. ERA

N78-30764# LKB Resources, Inc., Huntingdon Valley, Pa.
NURE AERIAL GAMMA RAY AND MAGNETIC RECONNAISSANCE SURVEY, THORPE AREA, NEWARK NK18-11 QUADRANGLE. VOLUME 1: NARRATIVE REPORT
Nov. 1977 108 p refs
(Contract EY-76-C-13-1664)
(GJBX-16(78)) Avail: NTIS HC A06/MF A01

A rotary wing combined airborne high sensitivity gamma ray and magnetic survey of four 1:250,000 quadrangles covering portions of Pennsylvania, New Jersey, and New York was conducted. The airborne system, field operations, data reduction, gamma-ray and magnetic data presentation, geology and uranium deposits of the Thorpe area, photogeologic enhance study of the Thorpe area, and data interpretation are discussed.
Author (ERA)

N78-30765# Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).
STATISTICAL INVESTIGATIONS ON THE ANGLE MEASUREMENTS IN THE BASIS MAGNIFICATION NETWORK GOETTINGEN 1961 Ph.D. Thesis - Tech. Univ. Berlin [STATISTISCHE UNTERSUCHUNGEN AN DEN WINKELMESSUNGEN IM BASISVERGROESSERUNGSNETZ GOETTINGEN 1961]
Juergen Bremer Bayerische Akad. der Wiss. 1977 103 p refs In GERMAN
(Ser-C/Diss-235; ISBN-3-7696-9291-8) Avail: NTIS HC A06/MF A01

The angle measurements were analyzed statistically with a view to improving the mathematical model of geodetic measurements. The basis magnification network Goettingen is introduced and the statistical analysis method is presented. The mathematical model is discussed. The adjustment results are presented, discussed, and compared with other measurements. Conclusions with respect to the validity of the mathematical model are presented. ESA

N78-30766# Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).
A THREE-DIMENSIONAL CALCULATION MODEL FOR GEODETIC POINT AND GEOID DETERMINATION Ph.D. Thesis - Tech. Univ. Berlin [EIN DREIDIMENSIONALES BERECHNUNGSMODELL FUER GEODAETISCHE PUNKT- UND GEOIDBESTIMMUNGEN]
Albrecht Preusser Bayerische Akad. der Wiss. 1977 102 p refs In GERMAN
(Ser-C/Diss-238; ISBN-3-7696-9293-4) Avail: NTIS HC A06/MF A01

A three-dimensional model for the determination of point fluids at the earth surface was derived. The model parameters are discussed, the observation equations are dealt with, special application possibilities are indicated, and the determination of the unknown parameter is treated. The choice of the supporting point, the interpolation radius, and the covariance function are dealt with. A listing of the COGMT computer program is annexed. ESA

N78-30767# Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).
INVESTIGATIONS ON THE APPLICATION OF SAMPLING FUNCTIONS IN GEODESY Ph.D. Thesis - Tech. Univ. Munich [UNTERSUCHUNGEN ZUR ANWENDUNG VON SAMPLING-FUNKTIONEN IN DER GEODAESIE]
Heinz Fritz Schmidt Bayerische Akad. der Wiss. 1978 148 p refs In GERMAN; ENGLISH summary
(Ser-C/Diss-241; ISBN-3-7696-92969) Avail: NTIS HC A07/MF A01

Departing from Whittaker's cardinal-function (1915) and the pulse function from information theory, the interpolation model of one-dimensional trigonometric sampling functions according to Lagrange polynomials was derived. An attempt was also made to represent them as a realization of the Dirac delta-function in the framework of the theory of distributions. The definition of two-dimensional sampling functions of a spherical harmonic development N is given. The sampling functions are associated to a defined grid of M = (N+1)(N+1) sampling points at a sphere. This type of function system together with the corresponding point parameters allows the representation of geodetically interesting functions, such as the geoid, gravity anomalies, the gravity potential, and topography of the earth, and also the determination of global parameters. The computation of the MxM coefficients of all sampling functions fails even when using modern computer facilities. Moreover, for an increasing degree N the amplitudes of the sampling functions increase extremely fast. As a consequence using sampling functions the approximate model and the potential coefficients (N = 36) derived for example, from simulated altimeter data and from real geoid

undulations or gravity anomalies produce unrealistic values between the sampling points. Thus, the expectation that sampling functions would allow reflection of the high resolution of locally collected observations in a global representation using an easy manageable, analytical model could not be confirmed from these investigations. Author (ESA)

N78-30768# Nebraska Geological Survey, Lincoln. Conservation and Survey Div.
REGIONAL TECTONICS AND SEISMICITY OF EASTERN NEBRASKA Annual Report, 1 Jun. 1976 - 1 Jun. 1977
Raymond R. Burchett Apr. 1978 23 p refs
(Contract AT(49-24)-0315)
(PB-281346/7; NUREG-CR-0053; IR-1) Avail: NTIS HC A02/MF A01 CSCL 08K

Available seismotectonic data in the study area is synthesized. In the initial year following maps have been made using existing data: (1) earthquake epicenter and intensity map; (2) a Precambrian configuration map; (3) a Precambrian rock type map; (4) a Bouger gravity map; (5) an aeromagnetic map; (6) a bedrock geology map; and (7) a structure contour map on the base of the Kansas City Group. The map data acquisition, the synthesis and the maps are discussed. GRA

N78-30769# Oklahoma Geological Survey, Norman.
SEISMICITY AND TECTONIC RELATIONSHIPS OF THE NEMAHA UPLIFT IN OKLAHOMA Annual Report, 1 Oct. 1976 - 1 Oct. 1977
K. V. Luza, R. L. DuBois, J. E. Lawson, P. Foster, and L. Koff Apr. 1978 82 p
(Contract AT(49-24)-0134)
(PB-281348/3; NUREG-CR-0050) Avail: NTIS HC A05/MF A01 CSCL 08K

Three key stratigraphic horizons in the study area were contoured. These are: The Viola formation, the base of the Pennsylvanian, and the top of the Oswego formation. A basement rock study of central Oklahoma is included. Seismological studies were devoted to installation of eight seismometers to include detailed coverage of the Nemaha Ridge. Five stations are now in full operation. A catalogue of Oklahoma earthquakes was prepared. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N78-30770 Washington Univ., Seattle.
THE MOLECULAR EFFECTS ON AIR-SEA EXCHANGES Ph.D. Thesis
Wing-Yuen Timothy Liu 1978 189 p
Avail: Univ. Microfilms Order No. 7814463

Air-sea exchanges through the interfacial region where molecular constraints dominate are studied. A flux profile relation in the interfacial sublayer is derived for free and force convection and under different roughness conditions. A laboratory experiment under free convection and a field experiment under forced convection was performed. This model is applied to determine the sea surface temperature from the bucket temperature and the results are compared with those of other studies. A numerical method is developed to determine the exchanges of momentum, sensible and latent heat with the bulk parameters, namely wind speed, humidity, air temperature and water temperature.
Dissert. Abstr.

N78-30771*# Chicago Univ., Ill. Dept. of the Geophysical Sciences.
MANUAL OF DOWNBURST IDENTIFICATION FOR PROJECT NIMROD
T. Theodore Fujita May 1978 108 p refs Original contains color illustrations
(Contract NGR-14-001-008; Contract NRC-04-74-239; NOAS-04-4-158-1)
(NASA-CR-156953; SMRP-RP-156) Avail: NTIS HC A06/MF A01 CSCL 04B

Aerial photography, Doppler radar, and satellite infrared imagery are used in the two year National Intensive Meteorological Research on Downburst (NIMROD) project to provide large area mapping of strong downdrafts that induce an outward burst of damaging winds over or near the earth. Topics discussed include scales of thunderstorm outflow; aerial photographs of downburst damage; microbursts and aviation hazards; radar echo characteristics; infrared imagery from GOES/SMS; and downburts-tornado relationships. Color maps of downbursts and tornadoes are included. A.R.H.

N78-30772# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PLANNING MODEL FOR PROFESSIONAL TRAINING IN METEOROLOGY [MODELO PARA O PLANEJAMENTO DE TREINAMENTO PROFISSIONALIZANTE EM METEOROLOGIA]
Zelia Maria Jofili Varejao Silva May 1977 146 p refs In PORTUGUESE; ENGLISH summary
(INPE-1029-TPT/052) Avail: NTIS HC A07/MF A01

A systematic instructional model for technical training observers in meteorology is presented. This method of instruction is expanded for selected disciplines to aid educators in planning professional technical training. S.B.S.

N78-30773*# Michigan Univ., Ann Arbor. Dept. of Atmospheric and Oceanic Sciences.
MICROPHYSICAL RESPONSE OF CLOUD DROPLETS IN A FLUCTUATING UPDRAFT Ph.D. Thesis
Duane D. Harding Jul. 1977 56 p refs
(Grant NsG-1243; Contract AT(11-1)-1407)
(NASA-CR-156954; UMICH-014311-1-S; UMICH-068670-3-S) Avail: NTIS HC A04/MF A01 CSCL 04B

The effect of a fluctuating updraft upon a distribution of cloud droplets is examined. Computations are performed for fourteen vertical velocity patterns; each allows a closed parcel of cloud air to undergo downward as well as upward motion. Droplet solution and curvature effects are included. The classical equations for the growth rate of an individual droplet by vapor condensation relies on simplifying assumptions. Those assumptions are isolated and examined. A unique approach is presented in which all energy sources and sinks of a droplet may be considered and is termed the explicit model. It is speculated that the explicit model may enhance the growth of large droplets at greater heights. Such a model is beneficial to the studies of pollution scavenging and acid rain. Author

N78-30774*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN ASSESSMENT OF THE EFFECT OF SUPERSONIC AIRCRAFT OPERATIONS ON THE STRATOSPHERIC OZONE CONTENT
I. G. Poppoff, R. C. Whitten, R. P. Turco (R and D Associates, Marina del Rey, Calif.), and L. A. Capone (San Jose State Univ., Calif.) Aug. 1978 60 p refs
(NASA-RP-1026; A-7399) Avail: NTIS HC A04/MF A01 CSCL 13B

An assessment of the potential effect on stratospheric ozone of an advanced supersonic transport operations is presented. This assessment, which was undertaken because of NASA's desire for an up-to-date evaluation to guide programs for the development of supersonic technology and improved aircraft engine designs, uses the most recent chemical reaction rate data. From the results of the present assessment it would appear that realistic fleet sizes should not cause concern with regard to the depletion of the total ozone overburden. For example, the NOx emission of one type designed to cruise at 20 km altitude will cause the ozone overburden to increase by 0.03% to 0.12%, depending upon which vertical transport is used. These ozone changes can be compared with the predictions of a 1.74% ozone decrease (for 100 Large SST's flying at 20 km) made in 1974 by the FAA's Climatic Impact Assessment Program. Author

N78-30775# Army Electronics Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 12 828D LANCE MISSILE NO. 3314 ROUND NO. 312 ESL (3 MARCH 1978)
Mar. 1978 27 p

(DA Proj. 1T6-65702-D-127)
(AD-A054458; ECOM-DR-968) Avail: NTIS HC A03/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 12828D Lance, Missile Number 3314, Round Number 312 ESL, are presented in tabular form. Author (GRA)

N78-30776# Army Electronics Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 19301B GSRS MISSILE NOS.. V-5/V-6, ROUND NOS. V-5/V-6 (11 JANUARY 1978)
Mar. 1978 28 p
(DA Proj. 1T6-65702-D-127)
(AD-A054457; ECOM-DR-967) Avail: NTIS HC A03/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19301B GSRS, Missile Numbers V-5/V-6, Round Numbers V-5/V-6, are presented in tabular form. Author (GRA)

N78-30777# Army Electronics Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 12831D LANCE MISSILE NUMBER 3317, ROUND NUMBER 311 ESL Meteorological Data Report
Mar. 1978 34 p
(DA Proj. 1T6-65702-D-127)
(AD-A054448; ECOM-DR-963) Avail: NTIS HC A03/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 12831D Lance, Missile Number 3317, Round Number 311 ESL, are presented in tabular form. Author (GRA)

N78-30778# Army Electronics Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 19301A GSRS MISSILE NUMBER V-1, ROUND NUMBER V-1, 5 DECEMBER 1977 Meteorological Data Report
Mar. 1978 24 p Supersedes ECOM-DR-953
(DA Proj. 1T6-65702-D-127)
(AD-A054454; ECOM-DR-964; ECOM-DR-953) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19301A GSRS, Missile Number V-1, Round No. V-1, are presented in tabular form. Author (GRA)

N78-30779# Army Electronics Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 19301A GSRS MISSILE NUMBER V-2, ROUND NUMBER V-2 (9 DECEMBER 1977)
Mar. 1978 22 p Supersedes ECOM-DR-956
(DA Proj. 1T6-65702-D-127)
(AD-A054455; ECOM-DR-965; ECOM-DR-956) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19301A GSRS, Missile No. V-2, Round No. V-2, are presented in tabular form. Author (GRA)

N78-30780# Army Electronics Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 19301 A GSRS MISSILE NOS. V-3/V-4, ROUND NOS. V-3/V-4, 14 DECEMBER 1977 Meteorological Data Report
Mar. 1978 21 p
(DA Proj. 1T6-65702-D-127)
(AD-A054456; ECOM-DR-966) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19301A GSRS, Missile Numbers V-3/V-4, Round Numbers V-3/V-4, are presented in tabular form. Author (GRA)

N78-30781# Army Electronics Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 14818C LANCE MISSILE NUMBER 2835, ROUND NUMBER 313 APT, 15 MARCH 1978 Meteorological Data Report
Apr. 1978 35 p
(DA Proj. 1T6-65702-D-127)
(AD-A054459; ECOM-DR-969) Avail: NTIS HC A03/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 14818C Lance, Missile Number 2835, Round Number 313 APT, are presented in tabular form. Author (GRA)

N78-30782# Air Force Armament Lab., Eglin AFB, Fla.
A COMPARISON OF MEASURED UPPER AIR TEMPERATURES AND TEMPERATURES DERIVED USING THE LAPSE RATE OF THE US STANDARD ATMOSPHERE Final Report, Jun. - Sep. 1977
Spence E. Peters, Jr. Nov. 1977 44 p refs
(AD-A054960; AFATL-TR-77-128) Avail: NTIS HC A03/MF A01 CSCL 04/2

Measured upper air temperatures at several locations were compared with temperatures derived using surface conditions and the lapse rate of the US Standard Atmosphere. The locations chosen were Helwan, Egypt; Mexico City, Mexico; Anchorage, Fairbanks, and Barrow, Alaska; Denver, Colorado; and Vandenberg Air Force Base and Edwards Air Force Base, California. It was shown that using a standard lapse rate can lead to large deviations from measured temperatures under realistic conditions. These conditions include temperature inversions, strong surface heating, non-standard tropopause heights, and high altitude locations. In several cases, differences between measured and derived temperatures exceeded 20 C. A method was presented which substantially reduced errors arising from low-level inversions by using a measured or forecasted temperature at 5000 feet above ground level. Author (GRA)

N78-30783# Sandia Labs., Tonopah, Nev.
FULL-SCALE TORNADO-MISSILE IMPACT TESTS Final Report
Alan E. Stephenson Jul. 1977 187 p refs
(Contract EY-76-C-04-0789)
(EPRI-NP-440) Avail: NTIS HC A09/MF A01

The design of nuclear plant auxiliary building walls and roofs to resist impact from tornado-generated missiles has most recently been based on subscale data and empirical formulae derived from military tests of limited applicability. The test program described in the report provides data from full-scale simulated tornado-missile impacts of reinforced concrete walls that can be used directly for design. In addition, the data can be used to develop improved design and analysis techniques This project is a part of an interdisciplinary program at EPRI aimed at providing a realistic basis for designing and analyzing nuclear power plants for the effects of hypothetical tornado-borne and in-plant missiles. The objective of the overall program is to ensure plant safety with efficient design. ERA

N78-30784# Wyoming Univ., Laramie.
LOCATING AREAS OF HIGH WIND-ENERGY POTENTIAL BY REMOTE OBSERVATION OF EOLIAN GEOMORPHOLOGY AND TOPOGRAPHY
Ronald W. Marrs and J. Marwitz 1977 23 p refs Presented at 3d Biennial Wind Energy Conversion Systems Conf., Washington, D. C., 19 Sep. 1977
(Contract EY-76-S-06-2343)
(RLO/2343-5; Conf-770921-5) Avail: NTIS HC A02/MF A01

An area in central Wyoming was chosen as the test site. The site contained many well-developed eolian landforms and was noted for its high winds. While some members of the research team interpreted satellite imagery and aerial photos and gathered field data in regions of dunes and blowouts, others compiled all available climatic information and collected additional data via low altitude flights with a specially instrumented aircraft. Observed characteristics of eolian features were then correlated with the wind data. Cause-and-effect interrelationships were identified and theoretical models were tested as possible explanations to the observed relationships. Relationships which proved useful in the Wyoming test area were then applied over a broader region and in other areas of the country to test for regional applicability of each predictor. ERA

N78-30785# National Oceanic and Atmospheric Administration, Washington, D. C. Environmental Data Service
MARINERS WEATHER LOG, VOLUME 22, NUMBER 2
Elwyn E. Wilson Mar. 1978 78 p
(PB-281389/7; NOAA-78041209) Avail: NTIS HC A05/MF A01 CSCL 04B

In addition to its regular sections this issue contains the

following articles: Kaohsiung, Taiwan, as a typhoon haven; North Atlantic tropical cyclones, 1977; end of an era; and an intense October northeast Pacific storm. GRA

N78-30786# National Weather Service, Salt Lake City, Utah.
DEVELOPMENT OF A PROBABILITY EQUATION FOR WINTER-TYPE PRECIPITATION PATTERNS IN GREAT FALLS, MONTANA
Kenneth B. Mielke Mar. 1978 20 p refs
(PB-281387/1; NOAA-TM-NWS-WR-27; NOAA-78041226)
Avail: NTIS HC A02/MF A01 CSCL 04B

Four parameters known to be reliable predictors of winter-type precipitation patterns (Oct-Mar)at Great Falls, Montana, are analyzed independently and then integrated into a probability of measurable precipitation equation. Five hundred fifty-one(551) cases are studied involving surface and upper-air data. The occurrence of precipitation at Great Falls, Montana, is strongly dependent upon the development of upslope conditions along the east slopes of the Rocky Mountains in Montana. Successive graphical regression analysis is first used to show the strength of the four parameters collectively. A probability equation is then developed by a linear regression program. The derived equation is compared with the Model Output Statistics and is shown to have practical value as a forecast tool. GRA

N78-30787# Utah Water Research Lab., Logan.
SEEDABILITY OF WINTER OROGRAPHIC STORMS IN UTAH Final Report, 1971 - 1977
Geoffrey E. Hill 15 Dec. 1977 86 p refs
(Contract DI-14-06-D-7184)
(PB-279149/9; A2) Avail: NTIS HC A05/MF A01 CSCL 04B

Randomized data from seeded and unseeded winter storms over the Wasatch Mountains are analyzed for the purpose of developing and designing cloud seeding technology. Two field programs were conducted sequentially; the first was done by airborne seeding and the second by seeding from mountaintop generators. Analysis of precipitation estimators based upon radar and/or rawinsonde data and target precipitation show that increased precipitation due to seeding may occur under certain meteorological conditions. Precipitation in these particular seeded storms was several times the amount estimated from relationships derived from meteorological parameters and unseeded precipitation. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N78-30788 Purdue Univ., Lafayette, Ind.
A FIELD INVESTIGATION OF THE SPATIAL AND TEMPORAL STRUCTURE OF LONGSHORE CURRENTS Ph.D. Thesis
Guy Allen Meadows 1977 184 p
Avail: Univ. Microfilms Order No. 7813086

Field investigations were conducted to obtain simultaneous and continuous measurements of the horizontal, vertical and temporal variability of the longshore current flow field. The study resulted in a two-dimensional mapping, across the surf zone and with depth, of the longshore current flow field. The investigation also shows that the total longshore current velocity vector, at any point across the surf zone, is composed of three distinct velocity components: (1) a steady component; (2) a long-period fluctuation component; and (3) a short-period fluctuation component. The existence of a low velocity zone in the longshore current flow field was isolated over the submarine bar. Dissert. Abstr.

N78-30789 California Univ., San Diego.
ANTHROPOGENIC ANGULAR MOMENTUM AND ITS RELATION TO SEVERE METEOROLOGICAL EVENTS, PART 1. THE DETECTION OF CONDUCTIVITY ANOMALIES IN THE OCEAN, PART 2 Ph.D. Thesis
James Wallace Stork 1978 182 p
Avail: Univ. Microfilms Order No. 7813154

Experiments were performed in the laboratory using a small vortex generator and a system of drag bodies to simulate passing automotive traffic acting on the atmosphere of a rotating system. These experiments supported many aspects of the postulated mechanism of the addition of angular momentum to the earth's atmosphere by automotive traffic. Further experiments were performed to measure the rate of diffusion of angular momentum in the atmosphere over a freeway. These experiments indicated that the rate of diffussion is consonant with the model used to explain the weekly periodicity and other statistical anomalies in the tornado record. A conductivity anomaly detector was developed that surveys large volumes of the ocean (1000's of cubic meters) at a time to locate and map areas of anomalous conductivity. The dectector was used to detect internal waves and map sewage outfalls. Dissert. Abstr.

N78-30790 Oregon State Univ., Corvallis.
SOME EFFECTS OF TOPOGRAPHY AND VERTICAL SHEAR ON LOW-FREQUENCY OCEAN FLUCTUATIONS Ph.D. Thesis
Tom Yao 1978 108 p
Avail: Univ. Microfilms Order No. 7811995

The role of coastal boundaries and bottom features in the ocean response to fluctuating winds is investigated with a simple model of a channel with depth variation along its length. The response is composed of linearized, barotropic topographic Rossby waves. An initial value problem for the perturbation by a bottom feature to a two-layer flow on a beta plane is discussed. The development in space and in time of the linearized baroclinically unstable disturbance is investigated. When the currents in the two layers are in the same direction and sufficiently strong, the growing part of the distrurbance is advected completely downstream. A steady solution is established in the region between the bottom feature and the tail of the transient. This solution may be a stationary wave if both currents are eastward. In other cases it is a net deflection of streamlines across the topography. Dissert. Abstr.

N78-30791 Rhode Island Univ., Kingston.
ABYSSAL PALEOCIRCULATION IN THE VEMA CHANNEL (SW ATLANTIC) Ph.D. Thesis
Michael Thomas Ledbetter 1977 130 p
Avail: Univ. Microfilms Order No. 7813267

The Vema Channel is a gap in the Rio Grande Rise in the southwest Atlantic through which high velocity Antarctic Bottom Water (AABW) flows north into the Brazil Basin and shallower North Atlantic Deep Water (NADW) flows south into the Argentine Basin. The transition zone separating the two water masses is marked by a sharp gradient in water properties and by pronounced changes in surface sediment properties. A sharp change in the mean particle size of the carbonate-free silt fraction from trigger core-top samples from coarse values within AABW to finer values within NADW lies near the mid-point in the benthic thermoline which is within the transition between the two water masses. The position of the sharp change in the silt mean particle size that marks the present transition between AABW and NADW shallows by approximately 100 meters at the end of the last ice age 18,000 years before present. The increase in volume transport from such a shallowing is approximately twenty percent. Dissert. Abstr.

N78-30792 California Univ., San Diego.
AN EXPERIMENTAL STUDY OF GRANULAR-FLUID FLOW Ph.D. Thesis
James Alan Bailard 1978 194 p
Avail: Univ. Microfilms Order No. 7813146

The flow of granular-fluids is studied experimentally and analytically. Balance equations preserving solid mass, linear momentum and angular momentum are presented. These equations are rigorous only when fluid-grain interactions are limited to fluid static pressure forces. This situation only exists when no slip occurs between solid grains and the surrounding immersing fluid. Two different constitutive equations (i.e., stress strain-rate equations) are discussed. Analytic solutions based on the constitutive equations are presented for three steady, fully developed granular-fluid flows. These include gravity and inertia-free rotational Couette flow, gravity flow down an inclined plane and gravity-free flow between two parallel planes.

Experimental concentration and velocity profiles are presented for the Couette and inclined plane flows. Dissert. Abstr.

N78-30793*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MONITORING CHANGES IN UPPER OCEAN HEAT STORAGE FROM SATELLITES
James R. Miller (Rutgers Univ., New Brunswick, N. J.) Jul. 1978 35 p refs
(NASA-TM-79601) Avail: NTIS HC A03/MF A01 CSCL 08J

A one-dimensional model of the upper ocean mixed-layer was developed to determine how the parameters which can be measured from satellites affect the development of the layer. The results show that the form of the dissipation term is important in achieving cyclic annual states, that the layer deepending rate depends on the averaging period for the surface heat flux and wind stress, that wind direction, as well as magnitude, can affect the deepening rate and that horizontal advective effects cannot simply be superimposed on the model results. An algorithm is given which uses satellite derived wind stress and sea surface temperature data to predict real time changes in upper ocean heat storage during the cooling seasons. G.G.

N78-30794# Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
EXPLANATION OF SUBMARINE LANDSLIDE MORPHOLOGY BY STABILITY ANALYSIS AND RHEOLOGICAL MODELS
Joseph N. Suhayda and David B. Prior May 1978 11 p Presented at 10th Ann. OTC Conf., Houston, Tex., 8-11 May 1978
(Contract N00014-75-C-0192)
(AD-A054927; TR-264) Avail: NTIS HC A02/MF A01 CSCL 08/10

A theoretical study of mass movement on the Mississippi River delta front has been made using recently acquired field data and a simple rheological model. Recent measurements of sediment properties include cohesion, bulk density, pore pressure, and internal friction angle. Also, the geometry of a typical type of instability feature, an elongate slide, is examined in detail. A rheological model describing a Coulomb-viscous plastic in effective stress terms is proposed to describe certain features of the mass movement process. The model is used to derive equations defining the initial failure of the slopes, the mass movement thickness and accelerations, the velocity of flow in the gullies, and the shape of the mud nose scarp in the toe area. The model indicates the importance of pore pressure in controlling sediment dynamics. Results of the model compare favorably with the observed shapes of mud noses. Initial failures on low slopes approximately 0.5 deg are attributed to pore pressures approaching geostatic values. Flow velocities are calculated to be several feet per second, based upon estimated sediment viscosities and pore pressures during flow. Author (GRA)

N78-30795# National Technical Information Service, Springfield, Va.
OCEAN WAVE SENSING. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1964 - May 1978
Audrey S. Hundemann Jun. 1978 243 p Supersedes NTIS/PS-77/0507, NTIS/PS-76/0435 NTIS/PS-75/413, and COM-74-10107
(NTIS/PS-78/0560/9; NTIS/PS-77/0507; NTIS/PS-76/0435; NTIS/PS-75/413; COM-74-10107) Avail: NTIS HC $28.00/MF $28.00 CSCL 08C

Abstracts pertaining to methods and equipment for measuring ocean waves and sea surface roughness are presented. Remote sensing of ocean waves, height indicators, wave spectrum measurement, the use of radar, wave direction detection, and a few abstracts dealing with general studies are included. (This updated bibliography contains 236 abstracts, 35 of which are new entries to the previous edition). GRA.

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N78-30796*# Texas Univ., Houston.
BIOCHEMICAL ADAPTATIONS OF ANTIGRAVITY MUSCLE FIBERS TO DISUSE ATROPHY Progress Report, 1 Aug. 1977 - 31 Jul. 1978
Frank W. Booth 31 Jul. 1978 28 p refs
(Contract NAS9-15388)
(NASA-CR-151822) Avail: NTIS HC A03/MF A01 CSCL 06C

Studies are presented in four parts of this report. The four parts include; (1) studies to gain information on the molecular basis of atrophy by antigravity muscle; (2) studies on the work capacity of antigravity muscles during atrophy and during recovery from atrophy; (3) studies on recovery of degenerated antigravity fibers after removal of hind-limb casts; and (4) studies on the atrophy and recovery of bone. The philosophy of these studies was to identify the time sequence of events in the soleus muscle of the rat following immobilization of the hind limbs, so that the length of the soleus muscle within the fixed limb is less than its resting length. In two separate studies, no decline in the weight of the soleus muscle could be detected during the first 72 hours of limb immobilization. G.Y.

N78-30797*# California Univ., Davis. Dept. of Animal Physiology.
EFFECT OF ALTERED GRAVITY ON TEMPERATURE REGULATION IN MAMMALS: INVESTIGATION OF GRAVITY EFFECT ON TEMPERATURE REGULATION IN MAMMALS Final Technical Report, Nov. 1973 - Jul. 1977
B. A. Horwitz and J. M. Horowitz Jul. 1977 7 p refs
(Grant NGR-05-004-099)
(NASA-CR-157570) Avail: NTIS HC A02/MF A01 CSCL 06C

Male, Long-Evans hooded rats were instrumented for monitoring core and hypothalamic temperatures as well as shivering and nonshivering thermogenesis in response to decreased ambient temperature in order to characterize the nature of the neural controller of temperature in rats at 1G and evaluate chronic implantation techniques for the monitoring of appropriate parameters at hypergravic fields. The thermoregulatory responses of cold-exposed rats at 2G were compared to those at 1G. A computer model was developed to simulate the thermoregulatory system in the rat. Observations at 1 and 2G were extended to acceleration fields of 1.5, 3.0 and 4.0G and the computer model was modified for application to altered gravity conditions. Changes in the acceleration field resulted in inadequate heat generation rather than increased heat loss. Acceleration appears to impair the ability of the neurocontroller to appropriately integrate input signals for body temperature maintenance. A.R.H.

N78-30798*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ASSESSMENT OF FREE-LIVING NITROGEN FIXING MICROORGANISMS FOR COMMERCIAL NITROGEN FIXATION
B. O. Stokes and C. J. Wallace 1 Aug. 1978 153 p refs
(Contract NAS7-100; Grant NSF AER-76-09093)
(NASA-CR-157565; JPL-Pub-78-60) Avail: NTIS HC A08/MF A01 CSCL 06C

Ammonia production by Klebsiella pneumoniae is not economical with present strains and improving nitrogen fixation to its theoretical limits in this organism is not sufficient to achieve economic viability. Because the value of both the hydrogen produced by this organism and the methane value of the carbon source required greatly exceed the value of the ammonia formed, ammonia (fixed nitrogen) should be considered the by-product. The production of hydrogen by KLEBSIELLA or other anaerobic nitrogen fixers should receive additional study, because the activity of nitrogenase offers a significant improvement in hydrogen production. The production of fixed nitrogen in the form of cell mass by Azotobacter is also uneconomical and the methane value of the carbon substrate exceeds the value of the nitrogen fixed. Parametric studies indicate that as efficiencies approach the theoretical limits the economics may become competitive. The use of nif-derepressed microorganisms, particularly blue-green algae, may have significant potential for in situ fertilization in the environment. A.R.H.

N78-30799*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SMD 3 POST TEST MEDICAL REPORT
Jerry R. Hordinsky 24 May 1977 24 p
(NASA-TM-79750; JSC-13076; SE-SMD-III-081) Avail: NTIS HC A02/MF A01 CSCL 06B

One of several reports that were prepared to document the results of the Spacelab Mission Development Test 3 is presented. This report covers clinical support to the crew as well as assistance and counsel to others in crew selection, health stabilization of the crew and the laboratory animals, and habitability and duty schedules. G.Y.

N78-30800# California Univ., Berkeley. Lawrence Berkeley Lab. Lab. of Chemical Biodynamics.
FERMENTATION AND HYDROCARBONS
Melvin Calvin 12 Jun. 1978 62 p refs Presented at 2d Latin-Am- Botan. Congr., Brasilia, Brazil, 22-27 Jan. 1978
(Contract W-7405-eng-48)
(LBL-7270; Conf-780128-1) Avail: NTIS HC A04/MF A01

Photosynthesis is examined as a possible annually renewable resource for material and energy. The production of fermentation alcohol from sugar cane as a major component of materials for chemical feedstocks is examined as well as the direct photosynthetic production of hydrocarbon from known plant sources. Experiments are underway to analyze the hydrocarbons from Euphorbias, Asclepias and other hydrocarbon-containing plants with a view toward determining their various chemical components. In addition, experimental plantings of plants of this type have begun to obtain data on which species would be the most successful. Work is also underway on the development of chemical process techniques for the extraction of plant materials after harvesting. In addition, efforts are underway to construct synthetic systems on the basis of the knowledge of the natural photosynthetic processes. These systems could be used to produce fuel, fertilizer, and power. As a result of studies of the natural quantum conversion process in green plants, several photoelectron transfer processes, some of which have already been demonstrated in synthetic systems, can be envisaged. Methods of constructing systems of this type and the principles of their use are described. ERA

N78-30801# National Technical Information Service, Springfield, Va.
BIOCHEMICAL OXYGEN DEMAND, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1975 - 1976
Robena J. Brown Jun. 1978 248 p
(NTIS/PS-78/0574/0) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

A broad range of citations dealing with biochemical oxygen demand (BOD) in sewage, industrial waste treatment, and limnology are presented. These studies include topics on BOD reduction, models, and biological factors. While many of the reports include a detailed analysis of BOD, some treat the subject only briefly. GRA

N78-30802# National Technical Information Service, Springfield, Va.
BIOCHEMICAL OXYGEN DEMAND, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1977 - May 1978
Robena J. Brown Jun. 1978 85 p Supersedes NTIS/PS-77/0417; NTIS/PS-76/0410; NTIS/PS-75/375; COM-73-11585 (NTIS/PS-78/0575/7; NTIS/PS-77/0417; NTIS/PS-76/0410; NTIS/PS-75/375; COM-73-11585) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

For abstract, see N78-30801.

N78-30803# Environmental Monitoring and Support Lab., Las Vegas, Nev. Monitoring Operations Div.
DISTRIBUTION OF PHYTOPLANKTON IN TENNESSEE LAKES Technical Report, 7 Mar. - 14 Nov. 1973
F. A. Hiatt, S. C. Hern, J. W. Hilgert, V. W. Lambou, F. A. Morris, M. K. Morris, L. R. Williams, and W. D. Taylor Jan. 1978 75 p refs Prepared in cooperation with Nevada Univ., Las Vegas
(PB-280139/7; EPA-600/3-78-016) Avail: NTIS HC A04/MF A01 CSCL 13B

The species and abundance data of phytoplankton in the 16 lakes sampled by the National Eutrophication survey in the State of Tennessee are presented. Results from the calculation of several water quality indexes are also included. GRA

N78-30804# Environmental Monitoring and Support Lab., Las Vegas, Nev. Monitoring Operations Div.
DISTRIBUTION OF PHYTOPLANKTON IN OHIO LAKES Technical Report, 7 Mar. - 14 Nov. 1973
J. W. Hilgert, V. W. Lambou, F. A. Morris, M. K. Morris, L. R. Williams, W. D. Taylor, F. A. Hiatt, and S. C. Hern Jan. 1978 102 p refs Prepared in cooperation with Nevada Univ., Las Vegas
(PB-280140/5; EPA-600/3-78-015) Avail: NTIS HC A06/MF A01 CSCL 13B

The data report presents the species and abundance of phytoplankton in the 20 lakes sampled in the State of Ohio. Results from the calculation of several water quality indices are also included (Nygaard's Trophic State Index, Palmer's Organic Pollution Index, and species diversity and abudance indices). GRA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N78-30805 Union Coll., Schenectady, N.Y.
THE ARTIFICIAL GILL: A STUDY OF ITS DEVELOPMENT, THEORY OF OPERATION, HUMANISTIC ASPECTS, AND DESIGN Ph.D. Thesis
Edgar Werner 1977 197 p
Avail: Univ. Microfilms Order No. 7811527

The artificial gill (or Agill) may be defined as a device by which a human being is enabled to exchange his metabolic gases (oxygen and carbon dioxide)in a liquid environment such as the sea, in essentially the same manner as in his normal air environment. The Agill is based on the principle that certain materials or compounds have the property of being permeable to those gases (or being solutes for them) while at the same time being impermeable to water. Dissert. Abstr.

N78-30806*+ National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 182, JULY 1978
Jul. 1978 57 p
(NASA-SP-7011(182)) Avail: NTIS HC E02 CSCL 06E

This bibliography lists 165 reports, articles, and other documents introduced into the NASA scientific and technical information system in June 1978. Author

N78-30807 Syracuse Univ., N. Y.
THE PSYCHOPHYSICAL TUNING CURVE: A PARAMETRIC STUDY Ph.D. Thesis
Charles Thomas Grimes 1977 142 p
Avail: Univ. Microfilms Order No. 7811652

The shape of psychophysical tuning curves under simultaneous masking as a function of three frequencies, three levels, and two durations of probe tones was investigated. Limited comparisons were made between the psychophysical tuning curves for three normal-hearing observers and one observer with hearing impairment of cochlear origin. The results indicate that the general shape of psychophysical tuning curves is consistent throughout the eighteen combinations of parameter vaules studied. These results are compared to previous investigations of psychophysical and neural tuning curves with respect to the specific effects of probe-tone parameter values on the shape of the curves. Irregularities in the shape of psychophysical tuning curves are discussed in relation to aural combination tones and other nonlinearities. The significance of psychophysical tuning curves as a measure of the quality of frequency selectivity in the impaired auditory system is also discussed. Dissert. Abstr.

N78-30808*# Florida Agricultural and Mechanical Univ., Tallahassee. School of Pharmacy.
REGULATION OF THE ADRENAL CORTEX FUNCTION DURING STRESS Annual Report
Karam F. A. Soliman 1 Sep. 1978 53 p refs
(Grant NsG-2183)
(NASA-CR-157397) Avail: NTIS HC A04/MF A01 CSCL 06S

A proposal to study the function of the adrenal gland in the rat during stress is presented. In the proposed project, three different phases of experimentation will be undertaken. The first phase includes establishment of the circadian rhythm of both brain amines and glucocoticoids, under normal conditions and under chronic and acute stressful conditions. The second phase includes the study of the pharmacokinetics of glucocorticoid binding under normal and stress conditions. The third phase includes brain uptake and binding under different experimental conditions. In the outlined experiments brain biogenic amines will be evaluated, adrenal functions will be measured and stress effect on those parameters will be studied. It is hoped that this investigation can explain some of the complex relationships between the brain neurotransmitter and adrenal function. Author

N78-30809# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
A GENERAL MYOCYBERNETIC CONTROL MODEL OF SKELETAL MUSCLE
H. Hatze Oct. 1977 47 p refs
(CSIR-SR-WISK-280; ISBN-0-7988-1214-1) Avail: NTIS HC A03/MF A01

A general myocybernetic control model of skeletal muscle is presented which constitutes an extension, to general control modes, of a previously published control model. The restriction, in the previous model, to a constant number of stimulated motor units was removed and the new model allowed for both a varying number of stimulated motor units and a varying average stimulation rate. The general model is tested by comparing its predictions with experimental records of the force output of the quadriceps femoris muscle. It is found that the model correctly predicts the initial excitation-contraction delay, the dips in the force record, and several other contraction phenomena. Author

N78-30810# IIT Research Inst., Chicago, Ill.
LASER-INDUCED THERMAL DAMAGE OF SKIN Final Report, Sep. 1976 - Apr. 1977
A. N. Takata, L. Zaneveld, and W. Richter Dec. 1977 159 p refs
(Contract F33615-76-C-0608; AF Proj. 7757)
(AD-A054612; IITRI-J6394; SAM-TR-77-38) Avail: NTIS HC A08/MF A01 CSCL 06/18

A computerized model was developed for predicting thermal damage of skin by laser exposures. Thermal, optical, and physiological data are presented for the model. Model predictions of extent of irreversible damage were compared with histologic determinations of the extent of damage produced in pig skin by carbon dioxide and ruby lasers. Author (GRA)

N78-30811# Defence Research Establishment Suffield, Ralston (Alberta).
EFFECT OF ATROPINE UPON THE CEREBROVASCULAR SYSTEM DURING GD-INDUCED RESPIRATORY DEPRESSION
J. A. Lipp and T. J. Dola Mar. 1978 15 p refs
(AD-A054807; DRES-TP-488) Avail: NTIS HC A02/MF A01 CSCL 15/2

The effect of GD-induced respiratory depression upon cerebral vascular physiology was studied in monkeys. There was a significant decrease in heart rate, mean arterial blood pressure, cerebral blood flow and cerebral perfusion pressure during the onset of respiratory depression, which terminated as apnea. Administration of atropine resulted in an immediate increase in all of the above mentioned parameters which coincided with improvement in respiration. It was concluded that GD impaired cerebral autoregulation, which resulted in a decrease in cerebral blood flow and cerebral perfusion pressure. It was suggested that respiratory depression resulted, in part, from anoxia. Administration of atropine increased the cerebral blood flow and cerebral perfusion pressure, which, in turn, possibly reversed the anoxic conditions resulting in the improvement of respiration. Author (GRA)

N78-30812# Illinois Univ. at the Medical Center, Chicago.
EFFECTS OF NOISE AND HEARING ACUITY UPON VISUAL DEPTH PERCEPTION AND SAFETY AMONG HUMANS Final Report
Edward R. Hermann Apr. 1978 41 p refs Sponsored by Illinois Inst. for Environ. Quality.
(Proj. 30.011)
(PB-280365/8; IIEQ-77-10) Avail: NTIS HC A03/MF A01 CSCL 06S

Exposure to steady-state broad-band, high-intensity noise ranging from 70 dbA to 115 dbA for time periods of several minutes did not produce significant changes in visual depth perception errors. Any error in stereoscopic depth perception produced by exposure of humans to broad-band white noise between 70 and 115 dbA is so small that such a perturbation is inadequate for establishing community or occupational noise standards. Other criteria are more important. GRA

N78-30813# Permanent Commission and International Association of Occupational Health. Subcommittee on the Toxicology of Metals.
TOXICOLOGY OF METALS, VOLUME 3
Feb. 1978 308 p refs Prepared in cooperation with National Swedish Environment Protection Board, and Karolinska Institutet
(Contract EPA-68-02-287)
(PB-280115/7; EPA-600/1-78-016) Avail: NTIS HC A14/MF A01 CSCL 06T

Contents: general chemistry of metals; sampling and analytical methods; sources, transport, and transformation of metals in the environment; effects-general principles underlying the toxic-action of metals; factors influencing effects and dose-response relationships of metals; epidemiological aspects of assessment of dose-response and dose-effect relationships; general aspects of the prevention of metal poisoning; general aspects and specific data on ecological effects of metals; standards and criteria; clinical effects, diagnosis and treatment of metal poisoning-general considerations; mutagenic and carcinogenic effects of metals. GRA

N78-30814# Yugoslav Academy of Sciences and Arts, Zagreb. Inst. for Medical Research and Occupational Health.
BIOLOGICAL SIGNIFICANCE OF SOME METALS AS AIR POLLUTANTS. PART 2: MERCURY Final Report, Jan. 1969 - Jan. 1974
Mirka Fugas, Fedor Valic (Zagreb Univ., Yugoslavia), and Andrija Stampar (Zagreb Univ. Yugoslavia) Jan. 1978 193 p refs
(Contract SFCP-02-302-3)
(PB-279670/4; EPA-600/1-78-002) Avail: NTIS HC A09/MF A01 CSCL 06T

The association is considered between low atmospheric mercury levels and changes in some biological parameters likely to react to such exposures. The study covered four populations believed to be exposed to four different levels of atmospheric mercury: rural inhabitants, town dwellers, population from a mercury mining and smelting town, and workers occupationally exposed to mercury. It is concluded that mercury exposure is likely to induce changes in the activity of cholinesterase, alkaline phosphatase, and glucose-6-phosphate dehydrogenase and also to cause changes in the concentration of coproporphyrin and probably glutathione. GRA

N78-30815# National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, Bethesda, Md.
TRANSCRIPTS OF THE 40TH MEETING PROCEEDINGS OF NATIONAL COMMISSION FOR THE PROTECTION OF HUMAN SUBJECTS OF BIOMEDICAL AND BEHAVIORAL RESEARCH
Mar. 1978 273 p refs Meeting held at Bethesda, Md., 10-11 Mar. 1978; sponsored by HEW
(PB-279916/1; NCPHS/M-78/03) Avail: NTIS HC A12/MF A01 CSCL 06E

The edition is a transcript of the March 10-11, 1978 meeting of the National Commission for the Protection of Human Subjects. Commission members discussed the following topics: (1) proposed

sterilization regulations, (2) ethical principles and guidelines for research involving human subjects, (3) institutional review boards, and (4) protection of patients receiving health services in DHEW programs. GRA

N78-30816# National Technical Information Service, Springfield, Va.
HYPOTHERMIA. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1964 - Apr. 1978
Elizabeth A. Harrison Jun. 1978 233 p Supersedes NTIS/PS-77/0419; NTIS/PS-76/0398
(NTIS/PS-78/0517/9; NTIS/PS-77/0419; NTIS/PS-76/0398) Avail: NTIS HC $28.00/MF $28.00 CSCL 06S

The selected abstracts cover high pressure narcosis, organ preservation, hyperbaric conditions, thermal homoeostasis, thermoregulation, cold stress, cold tolerance, physiological effects and cold water immersion as related to hypothermia. (This updated bibliography contains 227 abstracts, 22 of which are new entries to the previous edition.) GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N78-30817# National Inst. for Personnel Research, Johannesburg (South Africa).
MAN-ENVIRONMENT STUDIES: A REVIEW WITH AN ANALYSIS OF SOME TECHNIQUES FOR THE ASSESSMENT OF ENVIRONMENTAL PERCEPTION
S. Kushlick Sep. 1977 58 p refs
(CSIR-SR-PERS-271; ISBN-0-7988-1180-3) Avail: NTIS HC A04/MF A01

Man-environment studies with its resultant diversity of approaches and priorities are examined. These phenomena are classified into three main areas: (1) attitudes and values, (2) spatial behavior, and (3) adaptation of persons within a particular environmental setting. Methodological issues are summarized. Exploratory studies with three measurement techniques, (semantic differential, time-budgets, and cognitive mapping) which deal with the environment as it is experienced by the respondent are discussed. Consideration of the relevance of these techniques for environmental perceptual studies in general, and a South African population in particular, is incorporated in the discussions. S.E.S.

N78-30818# Civil Aeromedical Inst., Oklahoma City, Okla.
USE OF THE OCCUPATIONAL KNOWLEDGE TEST TO ASSIGN EXTRA CREDIT IN SELECTION OF AIR TRAFFIC CONTROLLERS
Mary A. Lewis Feb. 1978 12 p refs
(AD-A053675; FAA-AM-78-7) Avail: NTIS HC A02/MF A01 CSCL 05/9

The Occupational Knowledge Test (OKT) 101-B was administered to 784 air traffic control trainees who entered the FAA Academy's 16 week training course in 1976. All trainees completed the nonradar laboratory portion of the training and in addition completed a preemployment questionnaire. Based on responses to the questionnaire, the trainees were assigned to one of three experience groups corresponding to groups given credit for experience using Civil Service Commission (CSC) selection procedures. It was found that the OKT was highly correlated with experience (r = .64) and in addition the OKT had a higher correlation with successful completion of the nonradar lab than did experience (r = .25 vs .12). It was determined that use of an OKT score of 75 or above to assign extra credit would result in a failure rate of 3.1 percent for those receiving credit, while use of the current experience scale would result in a failure rate of 7.6 percent for those receiving extra credit on the CSC selection battery. The results held up for a cross-validation sample of 432 trainees who the Academy during 1977. Based on the results, it is recommended that an OKT score of 75 or above be used to assign extra credit for experience in the selection of air traffic controllers. Author

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N78-30819# Council for Scientific and Industrial Research, Pretoria (South Africa). Dept. of Technical Services.
INSTRUMENTATION FOR THE MEASUREMENT OF THE EVAPORATIVE AND RADIATIVE HEAT LOSS RATES FROM MAN IN A NORMAL WORKING MODE
T. Hodgson 1977 22 p refs Presented at the Intern. Conf. on Bioeng., Cape Town, Apr. 1977
Avail: NTIS HC A02/MF A01

Instrumentation that was developed for the direct measurement of the evaporative and radiative heat transfer rates between the human body in a natural working position and his environment in a 3 m x 3 m x 3 m test chamber with horizontal air flow is described. The evaporative heat loss measuring system incorporates a relatively simple albeit extremely sensitive differential hygrometer for detecting the humidity increase in the wake of the subject and a unique calibration system which involves the introduction of a known amount of steam into the wake of the body. The differential hygrometer is capable of detecting increases in specific humidity in the wake of the evaporating body as small as 4 x .000001 kg/kg. The radiation measuring system is in the form of a relatively thin rotating hoop; the inside and outside surfaces of the hoop being lined with thermal radiation sensing elements so connected as to measure the net radiation energy exchange between the subject and its surroundings. Full-scale tests involving the use of the instrumentation are referred to. Author

N78-30820*# General Electric Co., Schenectady, N. Y.
URINE MONITORING SYSTEM FAILURE ANALYSIS AND OPERATIONAL VERIFICATION TEST REPORT Final Report
E. J. Glanfield 22 Aug. 1978 63 p
(Contract NAS9-15230)
(NASA-CR-151828) Avail: NTIS HC A04/MF A01 CSCL 06B

Failure analysis and testing of a prototype urine monitoring system (UMS) are reported. System performance was characterized by a regression formula developed from volume measurement test data. When the volume measurement test data. When the volume measurement data was imputted to the formula, the standard error of the estimate calculated using the regression formula was found to be within 1.524% of the mean of the mass of the input. System repeatability was found to be somewhat dependent upon the residual volume of the system and the evaporation of fluid from the separator. The evaporation rate was determined to be approximately 1cc/minute. The residual volume in the UMS was determined by measuring the concentration of LiCl in the flush water. Observed results indicated residual levels in the range of 9-10ml, however, results obtained during the flushing efficiency test indicated a residual level of approximately 20ml. It is recommended that the phase separator pumpout time be extended or the design modified to minimize the residual level. J.M.S.

N78-30821*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A SEAT CUSHION TO PROVIDE REALISTIC ACCELERATION CUES FOR AIRCRAFT SIMULATOR PILOTS Patent Application
Billy R. Ashworth, inventor (to NASA) Filed 26 Jul. 1978 15 p
(NASA-Case-LAR-12149-2; US-Patent-Appl-SN-928131) Avail: NTIS HC A02/MF A01 CSCL 04H

A seat cushion for providing realistic acceleration cues to aircraft simulator pilots is presented. The novel feature of the invention appears to lie in the simulation of the events that happen in a seat cushion during actual flight to impact acceleration cues to the pilot. Also the novel controller has the ability to control the air pressure with sufficient response time and smoothness to adequately drive the seat cushion. Prior controllers were unable to adequately do this. NASA

N78-30822# School of Aerospace Medicine, Brooks AFB, Tex.
MOLECULAR SIEVE GENERATION OF AVIATOR'S OXYGEN: BREATHING GAS COMPOSITION AS A FUNCTION OF FLOW, INLET PRESSURE, AND CABIN ALTITUDE Interim Report, 1 Oct. 1976 - 30 Sep. 1977
Richard L. Miller, Clarence F. Theis, Roger L. Stork, and Kenneth G. Ikels Dec. 1977 28 p refs
(AF Proj. 7930)
(AD-A054240; SAM-TR-77-40) Avail: NTIS HC A03/MF A01 CSCL 01/3

The molecular sieve method of generating an enriched-oxygen breathing gas is one of three candidate on-board oxygen generation (OBOG) systems under joint Navy-Air Force development for application in tactical aircraft. As part of this program, the performance of a nominal 2-man-capacity molecular sieve oxygen generation system (MSOG) was characterized under simulated flight conditions. Data were given on the composition (oxygen, nitrogen, carbon dioxide, and argon) of the MSOG-generated breathing gas as a function of inlet air pressure, altitude, and gas flow rate. The maximum oxygen concentration observed was 95% with the balance argon. Under certain conditions of pressure, altitude, and flow, the argon enrichment factor exceeded that of oxygen giving a maximum argon concentration of 6.4% with the balance oxygen. The performance of the MSOG was discussed in the context of aircraft operating envelopes using both diluter-demand and 100% delivery subsystems.
Author (GRA)

N78-30823# School of Aerospace Medicine, Brooks AFB, Tex.
PRELIMINARY ANALYSIS OF AVAILABLE INFLIGHT RESPIRATORY DATA Interim Report, Jan. 1976 - May 1977
Thomas R. Morgan, F. Wesley Baumgardner, Joseph C. Crigler, Donald H. Reid, and Melvin A. Tays Dec. 1977 11 p refs
(AF Proj. 7930)
(AD-A054241; SAM-TR-77-20) Avail: NTIS HC A02/MF A01 CSCL 06/16

Pulmonary ventilation of aircrew members has been measured in 22 missions of C-130, T-38, A-4, F-4, and F-14 aircraft. Data were obtained by means of an inflight physiologic monitoring device which provides continuous simultaneous recording of expiratory flow, electrocardiograph, cabin pressure, acceleration, voice, and time code signals. This effort is the first wherein it has been possible to continuously track pilot respiratory needs and identify both the extent and frequency of variation from the mean. Although minute ventilations which were measured most frequently occurred in the range of previously published averages, a significant portion of the data exhibited higher levels. These higher levels generally corresponded with the performance of specific flight tasks. It is recommended that future oxygen system design requirements take into account these routinely encountered higher levels of ventilation. Author (GRA)

N78-30824# Rockwell International Corp., Anaheim, Calif. Autonetics Group.
ANALYSIS OF CREW/COCKPIT MODELS FOR ADVANCED AIRCRAFT
Charles P. Greening Feb. 1978 59 p refs
(Contract N00123-74-C-0236; WF55525000)
(AD-A054957; NWC-TP-6020) Avail: NTIS HC A04/MF A01 CSCL 09/2

The purpose of this study was to examine five active computer models of the aircrew/cockpit system, and to determine their relevance to current and future attack aircraft. The models were compared in terms of their general structure, input requirements, output options, and their sensitivity to a wide variety of equipment, mission, and operator characteristics. The models reviewed are similar in several important respects: They all require a detailed mission scenario and task analysis to steer the simulation; all require data on performance time and accuracy as inputs; and all generate outputs related to operator task load. The models differ widely in their sensitivity to significant variables. Recommendations for future work are presented. Author (GRA)

N78-30825# Naval Air Engineering Center, Lakehurst, N.J. Dept. of Ground Support Equipment.
RELIABILITY TEST REPORT. MODULAR CRYOGENIC GENERATOR Final Technical Report
R. Ferret 27 Apr. 1978 82 p refs
(AD-A054855; NAEC-92-124) Avail: NTIS HC A05/MF A01 CSCL 06/11

Reliability Testing of the LOX-30 Liquid Oxygen Plant was evaluated in accordance with MIL-STD-781. Reliability Tests were divided into Environmental Requirements, Reliability Growth and Reliability Demonstration Tests. Accept/reject criteria for the demonstration test was a specified MTBF of 1900 hours at the 30% risk level which was met. Four non-relevant failures occurred but had minor effect on the LOX-30 system. A failure distribution was established for the electro-pneumatic solenoid valves to be Log-normal. Author (GRA)

N78-30826# Southern Research Inst., Birmingham, Ala.
STUDY OF REACTIVE MATERIALS FOR DEVELOPMENT OF NEW PROTECTIVE CLOTHING CONCEPTS Final Report, 11 Nov. 1976 - 10 Nov. 1977
Donald R. Cowsar, Danny H. Lewis, and Gary W. Whitehead Jan. 1978 45 p refs
(Contract DAAA15-77-C-0015)
(AD-A054877; AD-E410022; SORI-3808-4; ARCSL-CR-78023) Avail: NTIS HC A03/MF A01 CSCL 15/2

This report describes investigations of reactive materials suitable for incorporation in or on fabrics for protection from percutaneous chemical warfare agents. Microencapsulated forms of alkali metal hydroxides and aliphatic amines were developed and found to be unsuitable for protection from HD. Aqueous solutions of aliphatic amines containing 4-(N,N-dimethylamino) pyridine were found to destroy GB on contact. Microcapsules comprising granules of stabilized XXCC3 in ethyl cellulose walls were found to react readily with HD. These microcapsules were bonded to 8 oz sateen fabric with resin binders, and the permeation of HD vapor through the fabric was determined. At contamination densities of 2.4 gm/sq m the HD vapor penetration was found to be 6 micrograms/sq cm. The treated fabrics were tested for stability toward washing and ultraviolet irradiation, and no change in agent vapor penetration was observed for either the washed samples or those subjected to irradiation for the equivalent of 1800 hours of sunlight. Author (GRA)

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

N78-30827# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: PHYSICAL SCIENCES AND TECHNOLOGY, NO. 46
22 Aug. 1978 83 p Transl. into ENGLISH from various Russian and French documents
(JPRS-71727) Avail: NTIS HC A05/MF A01

The development of computer networks and the use of automatic control in Soviet production planning and management is discussed. The use of Czechoslovakian electronic equipment in the Intercosmos program is reviewed. Tables are presented showing the various Soviet satellite launchings of 1977 and the scope of the Cosmos program over the past five years. For individual titles, see N78-30828 through N78-30832.

N78-30828# Joint Publications Research Service, Arlington, Va.

EFFICIENT USE OF COMPUTERS IN PLANNING DISCUSSED **c60**

M. Ye. Rakovskiy *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 46 (JPRS-71727) 22 Aug. 1978 p 1-6 Transl. into ENGLISH from Ekonomicheskaya Gazeta (Moscow), no. 23, Jun. 1978 p 14 (For primary document see N78-30827 21-59)

Avail: NTIS HC A05/MF A01

In accordance with the Soviet Agreement on the development of a unified system of electronic computers (YeS computers) and unified Principles for their application, an efficient structure and equipment were developed for monitoring the activity of the country's organizations and enterprises at the computer planning and development stage. Workers in industries and planning departments are attempting to achieve maximum production efficiency by adopting computer hardware and variable-purpose automatic control systems. A high-performance base was established for manufacturing electronic computers and peripheral units for them. Production of computer hardware is also expanding continuously in the socialist countries. The production volume and the products list of machines and instruments necessary for assembling complete variable-purpose automatic control systems are distributed among CEMA member countries. A.R.H.

N78-30829# Joint Publications Research Service, Arlington, Va.

WORK ON CREATION OF COMPUTER NETWORKS TOLD **c62**

E. Yakubaytis *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 46 (JPRS-71727) 22 Aug. 1978 p 7-10 Transl. into ENGLISH from Sov. Latv. (Riga), 15 Jun. 1978 p 2 (For primary document see N78-30827 21-59)

Avail: NTIS HC A05/MF A01

The economic and political significance of local computer networks is the Soviet Union is discussed. Experimental communications sessions with computers installed in Moscow, the United States, Belgium, Austria, Italy and France are being conducted. Trial sessions through communications satellites are going on. The institutes of the Academy of Sciences of the Latvian SSR are conducting work related to the creation of an academy-wide experimental computer network (EVS). The first line, already in experimental operation, includes twelve interconnected computers installed at these institutes: the physicoenergetics, mechanics of polymers, organic synthesis, the chemistry of wood and electronics and computer technology. In this network, having mini-equipment, it is possible to work with all the other machines and especially with the large electronic ones installed at the laboratory. The network processes architectural decisions, checks machine interaction methods, and creates the apparatus for rapid communications. A.R.H.

N78-30830# Joint Publications Research Service, Arlington, Va.

AUTOMATED CONTROL SYSTEM DISCUSSION CONTINUED **c63**

N. P Lebedinskiy *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 46 (JPRS-71727) 22 Aug. 1978 p 17-22 Transl. into ENGLISH from Ekonomicheskaya Gazeta (Moscow), no. 29, Jul. 1978 p 17 (For primary document see N78-30827 21-59)

Avail: NTIS HC A05/MF A01

To promote the methodological and organizational unity of automated control systems designed in the Soviet Union, a system was developed for working out national economic plans and monitoring their fulfillment under the conditions of widescale use of economic-mathematical methods and computers. The first section of the system provides for the solution of over 3,000 planning problems. Carrying out direct planning computations on electronic equipment made it possible to ensure the necessary precision and reliability of the national planning documents and raise the productivity of the planning workers considerably. A.R.R.

N78-30831# Joint Publications Research Service, Arlington, Va.

TEN YEARS OF WORK ON ELECTRONIC EQUIPMENT FOR THE INTERKOSMOS PROGRAM BY TESLA **c33**

Eng Vaclav Grim *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 46 (JPRS-71727) 22 Aug. 1978 33-44 Transl. into ENGLISH from Rev. Obchodu/Prumyslu/Hospodarstvi (Prague), no. 5, 1978 p 12-15 (For primary document see N78-30827 21-59)

Avail: NTIS HC A05/MF A01

Photometers for upper atmospheric and solar radiation investigations, meteorite detectors and partical analyzers, and telemetric and measuring transmitters for geophysical research are among the Czechoslovakian instruments developed for the Intercosmos program. Transmitters, antennas, and antenna amplifiers were provided for the uniform telemetric system which transmits in both analog and digital form. A spectral analyzer to process data acquired by satellites and transmitters in a broad analog spectrum is described as well as the design hybrid circuits, photomultipliers, and radiation detectors. The satellites and vertical rockets used in the Intercosmos program from 1968 to 1977 are listed showing the scientific tasks performed, the provenance of the instruments, and the nations cooperating in measuring and monitoring. A.R.H.

N78-30832# Joint Publications Research Service, Arlington, Va.

TENTATIVE ASSESSMENT OF 1977 COSMOS PROGRAM PROVIDED **c12**

Didier Laurent *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 46 (JPRS-71727) 22 Aug. 1978 p 45-60 Transl. into ENGLISH from Aeronaut. Astronaut. (Paris), no. 3, 1978 p 37-44 (For primary document see N78-30827 21-59)

Avail: NTIS HC A05/MF A01

The 105 Soviet satellites placed into orbit in 1977 included 19 satellites for specific space programs, and 86 Cosmos satellites for diverse purposes. Tables are presented showing the various designations, the place and date of launch, the launch vehicle, initial orbit, and purpose of each satellite. The scope of the Cosmos program from 1973 through 1977 for military and civil applications and in support of manned space flight is discussed. A.R.H.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering.*

N78-30833 Illinois Univ. at Urbana-Champaign, Urbana.

SEARCH FOR PARALLEL BINARY ADDERS WITH A MINIMUM NUMBER OF AND/OR GATES AND THEIR EXTENSION TO HIGH-SPEED PARALLEL MULTIPLIERS Ph.D. Thesis

Ging-Shung Yu 1978 202 p

Avail: Univ. Microfilms Order No. 78-11312

The design is given of AND/OR networks for n-bit carry-ripple adders using basic building modules. These building modules are obtained by modifying one-bit full adders obtained by the computer program ILLOD-(ANDOR-B) which is based on the integer programming logic design method. Each of these building modules consists of nine gates. It is proved that the minimum number of AND and OR gates required to realize an n-bit AND/OR carry-ripple adder is 9n under certain assumptions. An n-bit AND/OR carry-ripple adder with the minimum number of gates is easily modified to an n-bit completion-recognition adder to improve its speed. The design approach of an n-bit AND/OR carry-ripple adder with the minimum number of gates can also be extended to the case of networks which consist of carry save adders. Dissert. Abstr.

N78-30834 Illinois Univ. at Urbana-Champaign, Urbana.

COMPUTER SYSTEM DESIGN USING A HIERARCHICAL APPROACH TO PERFORMANCE EVALUATION Ph.D. Thesis

Balasubramanian Kumar 1978 168 p

Avail: Univ. Microfilms Order No. 78-11260

The procedure uses the hierarchy to trade off cost and

accuracy of system performance predictions. The viability and usefulness of the procedure are demonstrated by applying it to the optimization of the architecture of a complex computer system - the CPU - memory subsystem of the IMB System 360/Model 91. In most of the experiments conducted, the procedure converged, if not to the exact optimum, at least to within a very near region of the optimum. A sensitivity analysis procedure is then used to identify the exact optimum, as well as to determine the sensitivity of the objective function to changes in the system parameters. The efficiency of the overall procedure is shown to be considerably greater than that of the worst-case approach to system design. Some conclusions are drawn about this class of single stream, highly pipelines, CPU-memory architectures. Extensions of the hierarchical approach to performance evaluation are proposed. Dissert. Abstr.

N78-30835*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FAULT-TOLERANT BUILDING-BLOCK COMPUTER STUDY
David A. Rennels 15 Jul. 1978 18 p refs Sponsored in part by Naval Ocean Systems Center
(Contract NAS7-100)
(NASA-CR-157564; JPL-Pub-78-67) Avail: NTIS HC A02/MF A01 CSCL 09B

Ultra-reliable core computers are required for improving the reliability of complex military systems. Such computers can provide reliable fault diagnosis, failure circumvention, and, in some cases serve as an automated repairman for their host systems. A small set of building-block circuits which can be implemented as single very large integration devices, and which can be used with off-the-shelf microprocessors and memories to build self checking computer modules (SCCM) is described. Each SCCM is a microcomputer which is capable of detecting its own faults during normal operation and is described to communicate with other identical modules over one or more Mil Standard 1553A buses. Several SCCMs can be connected into a network with backup spares to provide fault-tolerant operation, i.e. automated recovery from faults. Alternative fault-tolerant SCCM configurations are discussed along with the cost and reliability associated with their implementation. A.R.H.

N78-30836# School of Aerospace Medicine, Brooks AFB, Tex.
AUTOMATED ENTRY OF DATA FROM THE AEROMEDICAL EVALUATION SUMMARY REPORT Final Report, Jun. 1975 - Jun. 1976
Harold N. Keiser, Bruce Montague, and William E. Nixon Jan. 1978 14 p
(AF Proj. 7755)
(AD-A054190; SAM-TR-78-1) Avail: NTIS HC A02/MF A01 CSCL 05/2

Aeromedical Evaluation Summary Sheets are prepared for each aircrewman referred to USAFSAM. These reports are prepared using an IBM Magcard 2 Selectric typewriter. The information entered on the form is recorded on magnetic cards and then transmitted to an IBM 360/65 computer with a communicating Magcard Selectric typewriter where it is prepared for entry into a repository. Corrections to the repository may also be made using the same equipment. Author (GRA)

N78-30837# Naval Ocean Systems Center, San Diego, Calif.
OVERVIEW OF CONCURRENT PASCAL FOR THE INTERDATA 7/16, DEVELOPED FOR THE CHANNEL ADAPTIVE RECEIVER TESTBED Final Report, Feb. - Nov. 1976
D. M. Cottel Feb. 1978 15 p refs
(XF21221701)
(AD-A054611; NOSC/TD-146) Avail: NTIS HC A02/MF A01 CSCL 09/2

This report describes the software system developed to support the Channel Adaptive Receiver (CAR) Project at the Naval Ocean Systems Center. Reasons are given for choosing the programming language Concurrent Pascal, as a basis for the software support system. An overview of the Concurrent Pascal implementation for the Interdata 7/16 minicomputer is presented. Author (GRA)

N78-30838# Los Alamos Scientific Lab., N. Mex.
MICROPROCESSOR DATA-INPUT-CONTROL UNIT FOR MARK CENTURY NUMERICAL CONTOURING CONTROL
C. D. Ethridge and W. M. Seifert 1978 10 p refs Presented at Conf. and Exhibit on Industrial Applications of Microprocessors, Philadelphia, 10 Mar. 1978
(Contract W-7405-eng-36)
(LA-UR-77-2052; Conf-780312-1) Avail: NTIS HC A02/MF A01

A microprocessor system is used to enhance the input capability of a Mark Century Numerical Contouring Control (XLO). The microprocessor system replaces the existing paper tape input medium with an equivalent-endless magnetic tape input cability for jobs requiring large amounts of input data. The micropressor system was added without modification to the XLO so that the paper tape medium can be utilized for existing jobs. ERA

N78-30839# Sandia Labs., Albuquerque, N. Mex.
GENERAL PURPOSE MAGNETIC TAPE HANDLER
Nolan A. Bourgeois, Jr. Oct. 1977 13 p
(Contract EY-76-C-04-0789)
(SAND-77-1492) Avail: NTIS HC A02/MF A01

A recently developed FORTRAN-callable general purpose magnetic tape handler is presented. The handler operates under the RT-11 operating system on a Digital Corporation PDP-11 family computer. Also included is a sample FORTRAN program. ERA

N78-30840# Los Alamos Scientific Lab., N. Mex.
COMPUTER GRAPHICS FOR EXTRACTING INFORMATION FROM DATA
Ronald K. Lohrding, Myrtle M. Johnson, and David E. Whiteman 1977 21 p refs Presented at the 3d ERDA Statist. Symp., Richland, Wash., 26-28 Oct. 1977
(Contract W-7405-eng-36)
(LA-UR-77-2456; Conf-771042-2) Avail: NTIS HC A02/MF A01

Computer graphics which are useful for displaying and analyzing data are presented. Many classical and several newly developed graphical techniques in statistical data analysis are presented for small univariate and multivariate data sets. These include histograms, empirical density functions, pie charts, contour plots, a discriminant analysis display, cluster analysis, Chernoff faces, and Andrews' sine curves. Recent advances in data collection technology and computer data base management systems have made it imperative to utilize computer graphics for large data sets. Several innovative graphical techniques are presented to handle this situation. Spatial relationships among the data (particularly geographic data) are difficult to conceptualize. Several cartographic techniques are presented which enhance the understanding of these spatial relationships within the data. ERA

N78-30841# Sandia Labs., Albuquerque, N. Mex.
PLANNING FOR DIGITAL SIGNAL PROCESSING WITHIN THE SLA PRODUCT DATA SYSTEM
J. R. Holpp 1977 9 p refs Presented at Digital Signal Processing Symp., Albuquerque, N. Mex., 6 Dec. 1977
(Contract EY-76-C-04-0789)
(Sand-77-1675C; Conf-771206-15) Avail: NTIS HC A02/MF A01

Data system plannning involves application of a concept which considers seven subsystems, namely determiniation, specifications, recording, processing, storage, retrieval and analysis, and destruction. The introduction of digitized waveforms acquired during product testing and the analysis of these signals impacts on several of these subsystems. Of particular significance in data planning is the fact that intelligent application of digital signal analysis is primarly problem dependent and requires more human intervention and interpretation than do other types of variables data analysis. In addition, storage problems become significant due to increased data volume, and present-day transmission techniques are inadequate-new recording, transmission, and storage concepts are needed. ERA

N78-30842# European Space Agency, Paris (France).
THE INTEL 8080 A MICROPROCESSOR AND ITS APPLICATION AS A DIGITAL FILTER
Kurt H. Moser and Joerg Schott Jun. 1978 50 p Transl. into ENGLISH of 'Der Mikroprozessor INTEL 8080 A und sein Einsatz als digitales Filter', DFVLR, Oberpfaffenhofen, West Ger.

Report DLR-IB-552-77/22, 29 Nov. 1977 Original report in GERMAN previously announced as N78-29779
(ESA-TT-484; DLR-IB-552-77/22) Avail: NTIS HC A03/MF A01

The structure of the INTEL 8080 microprocessor and particularly the properties of the calculation module SBC 80/10 and the 80/10 system is discussed. The construction of a digital filter for data recovery (extrapolation filter) in software and hardware is described. ESA

N78-30843# Royal Aircraft Establishment, Farnborough (England).
USING BRITISH STANDARD INTERFACES TO CREATE A FAST LINK BETWEEN TWO COMPUTERS
G. Sharples and G. F. Drury Jul. 1977 55 p refs
(RAE-TR-77010; BR59871) Avail: NTIS HC A04/MF A01

An ICL 1906S running under the GEORGE 4 operating system and a digital equipment PDP 11/40 were linked using British standard interfaces. The PDP 11 user is given access to the 1906S basic peripherals and filestore via the multi-access facilities of GEORGE. He also has the capability of transmitting files between the filestores of the two machines. The implementation of the inter-machine link is described and specifications for the hardware and software involved are given. Author (ESA)

N78-30844# Swedish Council for Building Research, Stockholm.
PROCESSING LARGE COORDINATED-BASED DATA BANKS
Dipak Khakhar 1978 130 p refs
(PB-280070/4; ISBN-91-540-2822-1; D2-1978) Avail: NTIS HC A07/MF A01 CSCL 09B

The use of how data bases in physical and social planning ought to be organized so that they can be transferred and combined easily for a particular application was studied. The Swedish road data base was used as an application for the calculation of shortest distances between some 3000 places and for the construction of a road distance table for Sweden. The results are derived from the distance table project, regarding the structuring and restructuring of data base for background map processing. GRA

N78-30845# General Accounting Office, Washington, D. C. Financial and General Management Studies.
THE FEDERAL INFORMATION PROCESSING STANDARDS PROGRAM: MANY POTENTIAL BENEFITS, LITTLE PROGRESS, AND MANY PROBLEMS
19 Apr. 1978 66 p
(PB-280280/9; FGMSD-78-23) Avail: NTIS HC A04/MF A01 CSCL 09B

Federal agencies have become locked into suppliers of computers and services because essential automatic data processing standards have not been developed or agencies are not complying with present standards. Information on the types of standards most needed to achieve Government-wide economies was provided. Remedies to improve the Federal automatic data processing standards program were suggested. GRA

N78-30828# Joint Publications Research Service, Arlington, Va.
EFFICIENT USE OF COMPUTERS IN PLANNING DISCUSSED
M. Ye. Rakovskiy *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 46 (JPRS-71727) 22 Aug. 1978 p 1-6 Transl. into ENGLISH from Ekonomicheskaya Gazeta (Moscow), no. 23, Jun. 1978 p 14 (For primary document see N78-30827 21-59)
Avail: NTIS HC A05/MF A01

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N78-30846 North Carolina Univ. at Chapel Hill.
PROGRAMMING IN REDUCTION LANGUAGES
Ph.D. Thesis
Mark Pozefsky 1977 225 p
Avail: Univ. Microfilms Order No. 78-10498

It is demonstrated that Reduction languages can be viewed as practical user language with respect to a particular machine model. The expression orientation and absence of variables force a structured, top-down, modularized approach to algorithm design. Functional, recursive, and combinatory programming techniques make proper program decomposition natural. A single syntactic entity, the sequence, simulates most existing information structures and obviates some other structures. Unbounded parallelism, associative referencing, and implicit storage management decrease the bookkeeping burdens on the programmer, allowing him to concentrate on the high level structure of his program. Testing and debugging are simplified because all data are literal, language primitives are so powerful, and sequencing control is simplified. Independence of expressions makes isolation and correction of errors easier. Dissert. Abstr.

N78-30847*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STANDARD PRACTICES FOR THE IMPLEMENTATION OF COMPUTER SOFTWARE
A. P. Irvine, ed. 1 Sep. 1978 219 p refs
(Contract NAS7-100)
(NASA-CR-157556; JPL-Pub-78-53) Avail: NTIS HC A10/MF A01 CSCL 09B

A standard approach to the development of computer program is provided that covers the file cycle of software development from the planning and requirements phase through the software acceptance testing phase. All documents necessary to provide the required visibility into the software life cycle process are discussed in detail. G.G.

N78-30848# Lockheed-California Co., Burbank.
SUMMARY OF 1977 INDEPENDENT RESEARCH ON USER ORIENTED REMOTE COMPUTING
R. W. Lingard and D. Saiki 14 Jul. 1978 51 p refs
(LR-28460) Avail: NTIS HC A04/MF A01

A computer system was designed and partially implemented which will provide a software interface between users, possibly inexperienced in computer processing techniques, and available programs and analysis systems. This system, denoted ASSIST (a scientific Software interface system for terminal users), aids users in accessing and utilizing existing applications software from remote terminals. The system provides three basic functions. It helps users find programs relevant to their problems; it assists them in preparing required input data; and it aids in the actual submittal of programs and data for computer processing. In addition, the system monitors usage of the facilities to ensure the efficient and proper use of available computer resources.
Author

N78-30849# California Univ., Santa Cruz. Information Sciences.
GENESIS: A LANGUAGE FOR DESCRIBING THE DEVELOPMENT OF PROGRAMS
W. B. Tyler and W. M. McKeeman Feb. 1978 27 p refs
(Contract N00014-76-C-0682)
(AD-A054282; TR-78-2-002) Avail: NTIS HC A03/MF A01 CSCL 09/2

A language, named GENESIS, is proposed for describing the program development process and bootstrapped programs in particular. It is concise (a seven line grammar) and general. The report contains syntax, semantics, examples and an approach to a formal semantics for the language. Author (GRA)

N78-30850# Mitre Corp., Bedford, Mass.
SECURITY KERNEL VERIFICATION TECHNIQUES: ALGORITHMIC REPRESENTATION
D. K. Kallman and J. K. Millen Apr. 1978 37 p refs
(Contract F19628-77-C-0001; Proj. 5220)
(AD-A054098; MTR-3289; ESD-TR-78-123) Avail: NTIS HC A03/MF A01 CSCL 09/2

A security kernel is a hardware and software mechanism that enforces access controls to information within a computer system. Given a formal specification for a kernel, this report shows how to construct an algorithmic or programming language representation of the kernel. A technique is suggested for proving

that the algorithmic representation exhibits the specified user-visible behavior. A sequence of lower levels of specification, formalizing the levels of abstraction of Dijkstra, is essential to the construction and proof technique. Author (GRA)

N78-30851# Naval Ship Research and Development Center, Bethesda, Md.
AN INVESTIGATION OF THREE COMPUTER PROGRAMS FOR THE SOLUTION OF AX=B WHERE A IS SYMMETRIC AND SPARSE Interim Report, Jun. 1977 - Feb. 1978
D. A. Gignac Apr. 1978 39 p refs
(SRO140301; ZF53532001)
(AD-A054602; DTNSRDC-78/033) Avail: NTIS HC A03/MF A01 CSCL 12/1

This report documents an investigation of three recent programs for the solution of AX = B where A is symmetric and sparse: the Yale Sparse Matrix Package; the Munksgaard subroutines; and the Mesztenyi-Rheinboldt subroutines. The first two programs compute in-core solutions; the third uses random access to obtain its solution. The performance of these three programs is compared with that of a previously developed out-of-core equation solver, CSKYDG2. The two in-core equation solvers (especially the first) are faster than CSKYDG2; the third is slower. All three provide the same degree of accuracy as CSKYDG2, but they require large amounts of core storage. It would appear that the two in-core equation solvers are not suited for use on the CDC 6000 series of computers in their present form due to the limited amount of core storage available. Although the third equation solver does not require as much core storage, it does not perform as well as existing out-of-core equation solvers which use the same or lesser amounts of core storage. Author (GRA)

N78-30852# Stanford Univ., Calif. Inst. for Mathematical Studies in the Social Sciences.
CURRICULUM INFORMATION NETWORKS FOR COMPUTER-ASSISTED INSTRUCTION Final Report
Marian Beard, Auron V. Barr, Laura Gould, and Keith Wescourt Apr. 1978 56 p refs
(Contract N00123-76-C-1543)
(AD-A054599; NPRDC-TR-78-18) Avail: NTIS HC A04/MF A01 CSCL 05/9

This report describes research in curriculum design for computer-assisted instruction. The issues and difficulties involved in courseware development are discussed, with particular emphasis on the problems of current generative techniques. The Curriculum Information Network, as used in the Basic Instructional Program (BIP), is described in detail and its advantages, weaknesses, and possible future development are discussed. Results obtained from analysis of students' experience with BIP are presented. Finally, the relevance of the network idea to Navy Technical Training is discussed and directions for future research are proposed. Author (GRA)

N78-30853# Synectics Corp., Rome, N. Y.
RASTER PLOTTER SOFTWARE IMPROVEMENTS Final Technical Report, Sep. 1976 - Sep. 1977
Vincent N. Cavo Mar. 1978 72 p refs
(Contract F30602-76-C-0440)
(AD-A055271; C-T0779-W; RADC-TR-78-64) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report describes the software required to generate the drive tapes for the Raster Finishing Plotters being used by the Defense Mapping Agency's production centers. The data is supplied as lineal (vector) feature strings and the software described in this report converts the lineal data to raster formatted data of the proper line weights. The output tape of the conversion routines are used to produce the cartographic color separation negatives on the Raster Finishing Plotters. Author (GRA)

N78-30854# School of Aerospace Medicine, Brooks AFB, Tex.
A FORTRAN PROGRAM TO FIT A COMPLEX-VALUED TRANSFER FUNCTION Final Report, Mar. - May 1976
Richard C. McNee and William G. Jackson, Jr. Mar. 1978 12 p ref
(AD-A054949; SAM-TR-78-7) Avail: NTIS HC A02/MF A01 CSCL 09/2

A procedure is given to obtain the estimate of a transfer function with up to eight parameters (gain, delay, 3 zeros, and 3 poles). An example of a subroutine used in conjunction with a program for least-squares estimation of nonlinear parameters is included. Author (GRA)

N78-30855# Sandia Labs., Albuquerque, N. Mex.
EDITOR: A TEXT EDITOR FOR THE PDP-11 (RT-11)
D. N. Tanner Mar. 1978 54 p
(Contract EY-76-C-04-0789)
(SAND-78-8205) Avail: NTIS HC A04/MF A01

EDITOR is used to create and modify any text or source program. The program runs on the PDP-11 with the RT-11 operating system (V2C or V3). EDITOR is a line editor with an emphasis on text safety and ease of use. Character string search and substitution, selective input and output, line printer and terminal listing features are provided. ERA

N78-30856# Sandia Labs., Albuquerque, N. Mex.
CDC 6600 SUBROUTINE FOR THE LOGARITHM OF THE GAMMA FUNCTION
Donald E. Amos Oct. 1977 7 p refs
(Contract EY-76-C-04-0789)
(SAND-77-1518) Avail: NTIS HC A02/MF A01

The gamma function is computed on a basic interval (2,3) by a rational Chebyshev approximation and extended to (0,8) by forward or backward recursion. The logarithm of the gamma function on (8,1000) is computed by another rational Chebyshev approximation, and the asymptotic expansion to two terms is used for arguments larger than 1000. Values for nonzero integer arguments up to 100 are stored and returned from a table look-up. ERA

N78-30857# Sandia Labs., Albuquerque, N. Mex.
USER/PROGRAMMER GUIDE FOR UCMD 65: ADDING TEXT FROM DISC TO AGS DRAWINGS
William C. Burd Oct. 1977 23 p refs
(Contract EY-76-C-04-0789)
(SAND-77-2024) Avail: NTIS HC A02/MF A01

A computer program UCMD 65 - an Applicon AGS/870 User Command for adding text from an AGS disc file to an AGS/870 drawing file is described. ERA

N78-30858# Royal Aircraft Establishment, Farnborough (England).
FORTRAN PROGRAMS FOR CONSTRAINED OPTIMIZATION
A. G. Purcell Sep. 1977 45 p refs
(RAE-TR-77142; BR60792) Avail: NTIS HC A03/MF A01

Four FORTRAN computer programs available for solving general constrained minimization problems are described. One (M0420) is suitable only when all the constraints are linear while the others (M0414K, M0415, M21IPF) are designed for nonlinear constraints. Of these, M21IPF is the most recent and the most efficient and has other desirable properties. All the underlying methods are described and compared and user guides to M0420 and M21IPF are provided as appendices. Author (ESA)

N78-30859# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
THE SPECIFICATION OF CODE GENERATION ALGORITHMS M.S. Thesis
Christopher J. Terman Jan. 1978 93 p refs
(Contract N00014-75-C-0661)
(AD-A054301; MIT/LCS/TR-199) Avail: NTIS HC A05/MF A01 CSCL 09/4

This thesis addresses the problem of automatically constructing the code generation phase of a compiler from a specification of the source language and target machine. A framework for such a specification is presented in which information about language and machine-dependent semantics is incorporated as a set of transformations on an internal representation of the source language program. The intermediate language which serves as the internal representation, and the metalanguage in which the transformations are written are discussed in detail. The major goal of this approach is to separate machine and language-dependent knowledge (as embodied in a transformation catalogue) from general knowledge about code generation. This general

knowledge is supplied by the third component of the framework: a metainterpreter incorporating a fairly complete repertoire of language and machine-independent optimization algorithms for intermediate language programs. The metainterpreter is also capable of selecting and applying transformations from the transformation catalogue. The three-component framework described in the thesis provides a specification that can easily be tailored to new languages and machine architectures without compromising the ability to generate optimal code.Author (GRA)

N78-30860# Research Inst. of National Defence, Stockholm (Sweden).
STRUCTURED SIMULATION PROGRAMMING
Jacob Palme Mar. 1978 26 p refs
(PB-280259/3; FOA-C10081-M3(E5)) Avail: NTIS HC A03/MF A01 CSCL 09B

A discussion of how structured programming techniques can be applied to the programming of simulation programs is presented. Special circumstances in simulation programming which will affect the way in which such programs are structured, were isolated. Topics examined include the following. (1) Why structured simulation programs, (2) Structuring dimension - the real world, (3) Structuring dimension - program tasks, (4) Structuring dimension - levels; and (5) level structuring in Simula. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N78-30861*# Computer Sciences Corp., Hampton, Va.
NASTRAN GENERAL PURPOSE INTERFACE REQUIREMENTS DOCUMENT Progress Report
W. Keith Brown, Frank J. Douglas, John R. McDonough, and David J. Ziobro Aug. 1978 73 p ref
(Contract NAS1-12969)
(NASA-CR-3038; CSC/TR-78/6006) Avail: NTIS HC A04/MF A01 CSCL 09B

This NASTRAN (NASA STRuctural ANalysis) General Purpose Interface Requirements Document (IRD) defines standards for deliverables required of New Capability Contractors (NCCs) and relates these deliverables to the software development cycle. It also defines standards to be followed by NCCs for adding to and modifying the code in the NASTRAN software system and for adding to and modifying the four official NASTRAN manuals: The NASTRAN Theoretical Manual, the NASTRAN User's Manual, The NASTRAN Programmer's Manual, and The NASTRAN Demonstration Problem Manual. It is intended that this General Purpose IRD shall be incorporated by reference in all contracts for a new NASTRAN capability. Author

N78-30862*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A DECODING PROCEDURE FOR THE REED-SOLOMON CODES
Raymond S. Lim Aug. 1978 25 p refs
(NASA-TP-1286; A-7372) Avail: NTIS HC A02/MF A01 CSCL 09B

A decoding procedure is described for the (n,k) t-error-correcting Reed-Solomon (RS) code, and an implementation of the (31,15) RS code for the I4-TENEX central system. This code can be used for error correction in large archival memory systems. The principal features of the decoder are a Galois field arithmetic unit implemented by microprogramming a microprocessor, and syndrome calculation by using the g(x) encoding shift register. Complete decoding of the (31,15) code is expected to take less than 500 microsecs. The syndrome calculation is performed by hardware using the encoding shift register and a modified Chien search. The error location polynomial is computed by using Lin's table, which is an interpretation of Berlekamp's iterative algorithm. The error location numbers are calculated by using the Chien search. Finally, the error values are computed by using Forney's method. L.S.

N78-30863# General Accounting Office, Washington, D. C. Logistics and Communications Div.
CHALLENGES OF PROTECTING PERSONAL INFORMATION IN AN EXPANDING FEDERAL COMPUTER NETWORK ENVIRONMENT
28 Apr. 1978 55 p
(PB-280179/3; LCD-76-102) Avail: NTIS HC A04/MF A01 CSCL 09B

The continuing concern, expressed by various congressional sources, over the ability to protect personal information in large computer networks is discussed. An overview of privacy and computer security problems is presented together with possible approaches which can provide protection for personal and other sensitive information. GRA

N78-30829# Joint Publications Research Service, Arlington, Va.
WORK ON CREATION OF COMPUTER NETWORKS TOLD
E. Yakubaytis *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 46 (JPRS-71727) 22 Aug. 1978 p 7-10 Transl. into ENGLISH from Sov. Latv. (Riga), 15 Jun. 1978 p 2 (For primary document see N78-30827 21-59)
Avail: NTIS HC A05/MF A01

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N78-30864 Wisconsin Univ. - Madison.
OPERATIONAL ASPECTS OF CENTRALIZED QUEUEING NETWORKS Ph.D. Thesis
James Paul Bouhana 1978 163 p
Avail: Univ. Microfilms Order No. 78-06408

Mathematical models of multiprogrammed computer systems expressed in the form of closed queueing networks are presented. A new methodology of network analysis which proceeds by way of considering nested similarity transformations of a network's transition matrix is introduced. Using this method, eigenvector equations for the mean number of per-customer visits to each server and the mean total per-customer service time (i.e., mean resource usage) for each server. For separable networks which are not necessarily centralized, the product-form solution is used to develop a new equation relating server utilization to a network's solution parameters. Single device utilizations measured at consecutive levels of multiprogramming are used to derive mean queue lengths and certain marginal distributions pertinent to the device. Dissert. Abstr.

N78-30865 Illinois Univ. at Urbana-Champaign, Urbana.
ANALYSIS AND SYNTHESIS OF HIGH GAIN AND VARIABLE STRUCTURE FEEDBACK SYSTEMS Ph.D. Thesis
Kar-Keung David Young 1978 193 p
Avail: Univ. Microfilms Order No. 7811311

The analysis and synthesis of two classes of multivariable feedback systems, high gain feedback systems and variable structure systems (VSS), subjected to parameter variations and disturbances are studied. The insensitivity property of high gain state feedback systems is examined. The idea of incorporating high gain feedback loops in observers is then introduced and the behavior of the resulting two-high-gain-loops system is investigated. A design procedure which enhances the insensitivity of the closed loop system for the high gain feedback matrices is developed. The relationship between high gain feedback systems and VSS is established. The insensitivity property of VSS is revealed. Then, observers with variable structure are developed and the behavior of the resulting VSS with variable structure observers is examined. The robustness property of these two classes of feedback systems with respect to model reduction, is studied. Finally, the insensitivity of these two classes of feedback control to enhance the reliability of interconnected systems is explorted. Dissert. Abstr.

N78-30866# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering and Computer Science.
SIMULATION METHOD OF FEATURE SELECTION FOR UNCONSTRAINED HANDPRINTED CHARACTERS M.S. Thesis

Robert Tornow Babcock May 1977 100 p refs
(AD-A054755) Avail: NTIS HC A05/MF A01 CSCL 06/4

A theory of character recognition and associated methodology which is expected to lead to a machine algorithm for recognizing unconstrained handprinted characters is reviewed and expanded to encompass the previously excluded Arabic numerals. A computer character generator package developed for this and future work is described. By way of example, its use in generating the test stimuli for this work is explained. The character pair 2-Z is selected for study in this work. A systematic method of describing the essential difference between the characters is employed. Three psychophysical experiments, labeling, reaction time and goodness are described and used to determine a quantitative rule for distinguishing between 2s and Zs in neutral context. This thesis serves as a guide for initial investigation of other intercharacter boundary rules. The collection of rules should eventually describe a general character recognition algorithm.
Author (GRA)

N78-30867# Maryland Univ., College Park. Dept. of Computer Science.

SOME CURRENT CONCEPTS AND PROBLEMS IN PATTERN CLASSIFICATION AND FEATURE EXTRACTION

Laveen N. Kanal Apr. 1978 38 p refs
(Grants AF-AFOSR-2901-76; NSF ENG-73-04099)
(AD-A054852; TR-640; AFOSR-78-0958TR) Avail: NTIS HC A03/MF A01 CSCL 06/4

Noting the major limitations of the much developed multivariate statistical and syntactic pattern recognition models, this paper describes--in a tutorial manner--alternate representations, based on stage-space and AND/CR graphs and ordered search strategies, for multistage and nearest neighbor classification and for structural pattern analysis and feature extraction. Some recent work in pattern recognition is reviewed from these vantage points. In addition, the paper touches on recent contributions to the continuing attempts to understand feature subset selection, measurement complexity and nonparametric classification and error estimation. Surveys, conference proceedings and edited collections providing quick access to the recent literature on pattern recognition methodologies and applications, are cited in the bibliography. Author (GRA)

N78-30868# Delaware Univ., Newark. Dept. of Statistics and Computer Science.

ON THE MERITS OF AN APPROXIMATION TO THE BUSY PERIODS OF THE GI/G/1 QUEUE

V. Ramaswami Mar. 1978 16 p refs
(Grant AF-AFOSR-3236-77)
(AD-A054885; TR-78/3; AFOSR-78-0984TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

An approximation for computing the busy period characteristics in the GI/G/1 queue, is shown to be lacking in accuracy, and is therefore quite undesirable for practical use. GRA

N78-30869# Delaware Univ., Newark. Dept. of Statistics and Computer Science.

ON THE TRADE-OFF BETWEEN QUEUE CONGESTION AND SERVER'S REWARD IN A M/M/1 QUEUE

Guy Latouche Apr. 1978 35 p refs
(Grant AF-AFOSR-3236-77)
(AD-A054886; TR-78/7; AFOSR-78-0985TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

One can observe, in the literature on queueing theory, a growing interest in the control of the arrival process. For most of the published models, the aim is to maximize the difference between fees collected and costs: it is explicitly assumed that the fees and costs can be measured and are expressed in the same units. This paper considers the two objectives of maximizing the fee collected and minimizing queue congestion as distinct. If it is not possible to optimize these simultaneously, then the problem will be to maintain one of them at a reasonable level and, under that constraint, to optimize the other. GRA

N78-30870# Delaware Univ., Newark. Dept. of Statistics and Computer Science.

FURTHER RESULTS ON THE M/M/1 QUEUE WITH RANDOMLY VARYING RATES

Marcel F. Neuts 1978 24 p refs
(Grant AF-AFOSR-3236-77)
(AD-A054884; TR-78/4; AFOSR-78-0983TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The M/M/c queue, with arrival and service rates which vary according to the state of a Markov process, has a steady-state probability vector of a modified matrix-geometric form. The rate matrix R is the unique positive solution to a quadratic matrix equation, which may be solved numerically by successive substitutions. A theorem which provides an accuracy check on that computation is proved. Finally, a numerical example is discussed and its results are interpreted. GRA

N78-30871# Delaware Univ., Newark. Dept. of Statistics and Computer Science.

THE N/G/1 QUEUE AND ITS DETAILED ANALYSIS Ph.D. Thesis - Purdue Univ.

V. Ramaswami Apr. 1978 78 p refs
(Grants AF-AFOSR-3236-77; AF-AFOSR-2350-72)
(AD-A054883; TR-78/1; AFOSR-78-0982TR) Avail: NTIS HC A05/MF A01 CSCL 12/1

A single server queue is discussed whose input is the versatile Markovian point process, herein to be called the N-Process. Special cases of the N-Process include a number of complex models such as the Markov-modulated Poisson Process, the superposition of a Poisson Process and a Phase Type Renewal Process etc. This queueing model has great appeal in its applicability to real world situations especially such as those involving inhibition or stimulation of arrivals by certain renewals. The paper presents formulas in forms which are computationally tractable and provides a unified treatment of many models which turn out to be special cases. Among the topics discussed are busy period characteristics, queue length distributions, moments of the queue length and virtual waiting time. The analysis presented here serves as an example of the power of Markov Renewal Theory. GRA

N78-30872# Delaware Univ., Newark. Dept. of Statistics and Computer Science.

SOME EXPLICIT FORMULAS AND COMPUTATIONAL METHODS FOR INFINITE SERVER QUEUES WITH PHASE TYPE ARRIVALS

V. Ramaswami and Marcel F. Neuts Apr. 1978 65 p refs Prepared in cooperation with Purdue Univ.
(Grants AF-AFOSR-3236-77; AF-AFOSR-2350-72)
(AD-A054882; TR-78/5; AFOSR-78-0981TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

This paper discusses infinite server queues whose input is a Phase Type Renewal Process. The problems of obtaining the transient and steady-state distributions and moments of the queue length are reduced to the solution of certain well-behaved systems of linear differential equations. Sample computations are provided with as many as ten phases. The paper contains some useful explicit formulas and also discusses the interesting special case where the service time is also of phase type. The Phase Type Distributions include a wide variety of models such as generalized Erlang, hyperexponential (mixtures of a finite number of exponentials) as very special cases and possess great versatality in modeling a number of interesting qualitative features such as bimodality. GRA

N78-30873# Loughborough Univ. of Technology (England). Dept. of Mathematics.

A NOTE ON THE CONTROLLABILITY OF LINEAR CONSTANT DELAY-DIFFERENTIAL SYSTEMS

M. G. Frost (Trent Polytech., Nottingham) and C. Storey Jul. 1977 13 p refs
(MATHS-Res-113) Avail: NTIS HC A02/MF A01

The possibility of extending some well known results in the theory of linear constant ordinary differential systems to the theory of delay-differential systems was examined with reference to the R(n)-controllability of the latter type of systems. Several types of controllability have been defined for linear constant delay-differential systems. Certain necessary and sufficient conditions involving a form of controllability matrix for these systems were investigated. Particular reference was made to the concept of R(n)-controllability. Author (ESA)

N78-30830# Joint Publications Research Service, Arlington, Va.
AUTOMATED CONTROL SYSTEM DISCUSSION CONTINUED
N. P. Lebedinskiy *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 46 (JPRS-71727) 22 Aug. 1978 p 17-22 Transl. into ENGLISH from Ekonomicheskaya Gazeta (Moscow), no. 29, Jul. 1978 p 17 (For primary document see N78-30827 21-59)
Avail: NTIS HC A05/MF A01

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N78-30874 Wisconsin Univ. - Madison.
A MATHEMATICAL PROGRAMMING TIME-SHARING SYSTEM USING A PRECOMPILER AND NUMERICAL DERIVATIVES Ph.D. Thesis
James Lee Noyes 1977 219 p
Avail: Univ. Microfilms Order No. 78-06442

An inelaborate FORTRAN precompiler was implemented for the Univac 1110, which accepts mathematical programming commands and problem-defining FORTRAN statements and allows selected algorithms to be invoked from an associated software library. In order for this system to be genuinely easy to use, any gradient and Hessian information required by the minimization algorithms may be either entered directly or approximated by accurate Richardson extrapolated forward or central finite-difference schemes. Several finite-difference formulas are developed and applied to certain standard minimization algorithms. Tests results are also provided to allow accuracy comparisons of standard algorithms (such as SUMT).
Dissert. Abstr.

N78-30875 California Univ., Berkeley.
LINEARIZATION STABILITY OF COUPLED GRAVITATIONAL AND GAUGE FIELDS Ph.D. Thesis
Judith Meryl Arms 1977 52 p
Avail: Univ. Microfilms Order No. 7812476

The work of Fischer, Marsden, and Moncrief on linearization stability of vacuum spacetimes is extended to the case of gravity coupled with a sourceless gauge field. (Linearization stability concerns the validity of first order perturbation theory. A nonlinear equation is said to be linearization stable when solutions of the linearized equation are tangent to curves of solutions of the original nonlinear equation.) For a spacetime with a compact Cauchy surface and a gauge field with matrix gauge group whose Lie algebra admits an adjoint action invariant nondegenerate metric, conditions are obtained for linearization stability of the coupled Einstein-Yang-Mills field equations. These conditions are sufficient conditions on the Cauchy surface and necessary and sufficient conditions on the spacetime. Roughly speaking, the results state that linearization stability can be guaranteed when the fields aren't too symmetrical. Thus a generic solution, which lacks symmetry, is linearization stable. Dissert. Abstr.

N78-30876# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
DETECTION OF IMAGE BOUNDARIES: MATHEMATICAL FORMULAS [DETECCAO DE BORDAS EM IMAGENS: FORMULACAO ESTATISTICA]
Nelson Delfino Davila Mascarenhas and Lucila Olivia daCosta Prado Jul. 1977 44 p refs In PORTUGUESE; ENGLISH summary
(INPE-1058-NTE/094) Avail: NTIS HC A03/MF A01

New statistical techniques for the boundary detection problem in earth resources imagery are developed. The image is modeled by signal and noise which are additive, independent, gaussian and autorregressive in two dimensions. The parameters of the model are determined by correlation measurements. The optimal solution, in terms of signal detection theory, leads to a test which takes a decision among seven overlapping hypothesis. A computationally attractive suboptimal test, involving non-overlapping hypothesis is developed. Simulation results of the algorithm, when applied to groups of four pixels of the image, are presented. Author

N78-30877*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON LEAST SQUARES COLLOCATION
Peter D. Argentiero Jun. 1978 20 p refs
(NASA-TM-79575) Avail: NTIS HC A02/MF A01 CSCL 12A

It is shown that the least squares collocation approach to estimating geodetic parameters is identical to conventional minimum variance estimation. Hence, the least squares collocation estimator can be derived either by minimizing the usual least squares quadratic loss function or by computing a conditional expectation by means of the regression equation. When a deterministic functional relationship between the data and the parameters to be estimated is available, one can implement a least squares solution using the functional relation to obtain an equation of condition. It is proved the solution so obtained is identical to what is obtained through least squares collocation. The implications of this equivalance for the estimation of mean gravity anomalies are discussed. Author

N78-30878# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
AUTOMATIC NUMERICAL INTEGRATION OVER A TRIANGLE
D. P. Laurie Sep. 1977 18 p refs
(CSIR-SR-WISK-273; ISBN-0-7988-1186-2) Avail: NTIS HC A02/MF A01

A new seven-point integration formula is derived which gives an error estimate and defines a subdivision strategy for use with an adaptive automatic integrator over a triangle. Numerical examples and listings of three FORTRAN subroutines are included. Author

N78-30879# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
HOW TO GENERALIZE THE CONCEPT OF A FUNCTION
Reuven Meidan Sep. 1977 14 p refs Presented at the 20th Ann. Congr. of the South African Math. Soc., Bloemfontein, South Africa, Oct. 1977
(CSIR-SR-WISK-275; ISBN-0-7988-1189-7) Avail: NTIS HC A02/MF A01

The shortcomings of ordinary functions in analysis are outlined. The remedy proposed is based on Schwartz's distribution theory. The same procedure is adopted for vector-valued functions and in particular for stochastic processes. The current status of research in some relevant fields is outlined. Author

N78-30880# Stanford Univ., Calif.
A FAST ALGORITHM FOR FINDING DOMINATORS IN A FLOW GRAPH
Thomas Lengauer and Robert Endre Tarjan Mar. 1978 42 p refs
(Contract N00014-76-C-0688; Grant NSF MCS-75-22870)
(AD-A054144; SU-STAN-CS-78-650) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper presents a fast algorithm for finding dominators in a flow graph. The algorithm uses depth-first search and an efficient method of computing functions defined on paths in trees. A simple implementation of the algorithm runs in O(m log n) time, where m is the number of edges and n is the number of vertices in the problem graph. A sophisticated implementation runs in O(M alpha (m, n)) time, where alpha(m, n) is a functional inverse of Ackermann's function. Both versions of the algorithm were implemented in Algol W, and tested on an IBM 370/168. The programs were compared with an implementation by Purdom and Moore of a straightforward O(mn) - time algorithm, and with a bit vector algorithm. The fast algorithm beat the straightforward algorithm and the bit vector algorithm on all but the smallest graphs tests. GRA

N78-30881# Naval Ship Research and Development Center, Bethesda, Md. Computation Mathematics/Logistics Dept.
SPECIFICATIONS FOR A SOLID FINITE ELEMENT DATA GENERATOR
Richard J. Kazden Mar. 1978 30 p refs
(AD-A054126; CMLD-78-04) Avail: NTIS HC A03/MF A01 CSCL 12/1

Specifications are given for the implementation of a solid finite element data generation capability that uses geometric information obtained from a geometry processing program called G-PRIME. A proposed user definition format is described; the characteristics of finite element models that could be generated with this capability are discussed, and two sample problems are presented to illustrate the proposed technique. Author (GRA)

N78-30882# Rockwell International Science Center, Thousand Oaks, Calif.
WEIBULL PREDICTION INTERVALS FOR FINITE LOTS WHEN TESTING OCCURS AT STRESS LEVELS OTHER THAN NOMINAL
Nancy R. Mann Apr. 1978 20 p refs
(Contract N00014-73-C-0474)
(AD-A054233) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this paper a two-parameter Weibull model is assumed for time to failure (or number of cycles to failure). The inverse power law is assumed to relate level of stress and the Weibull scale parameter with the Weibull shape parameter independent of stress level. It is supposed that a life test results in Weibull failure-time data applying to the first r failures in a sample of size n. The procedure derived herein allows one to use these data to obtain an approximate lower confidence bound on the time of the i-th failure in a lot of size m selected from the same population as the sample. The precision of the approximation is investigated for certain cases in which i = 1, that is, the first failure in a lot is of interest. A method is given for determining whether the approximation is sufficiently precise for use, and an example of use of the approximation is provided. Author (GRA)

N78-30883# Princeton Univ., N. J. Plasma Physics Lab.
INTERACTIVE CODE FOR SOLVING DIFFERENTIAL EQUATIONS USING PHASE INTEGRAL METHODS
R. B. White Mar. 1978 36 p refs
(Contract EY-76-C-02-3077)
(PPPL-1428) Avail: NTIS HC A03/MF A01

The solution of ordinary differential equations by the means of phase integral methods is eminently suited for an interactive computational system with real time graphics. A code devised for this purpose and to illustrate its use is described. ERA

N78-30884# Los Alamos Scientific Lab., N. Mex.
USE OF RANK TRANSFORMATIONS IN THE SELECTION OF VARIABLES
A. Goldman and W. J. Conover Nov. 1977 11 p refs
(Contract W-7405-eng-36)
(LA-7005-MS) Avail: NTIS HC A02/MF A01

Three examples involving multivariate data are presented in which a regression analysis on the ranks of the data yields useful information concerning the selection of the best set of independent variables. This method of analysis is compared with ordinary regression of independent variables. The regression analysis on ranks appears to have two advantages. It furnishes consistent results in the presence or absence of outliers, while the usual regression methods select different variables when outliers are present. Also, the selection of variables using ranks agrees with the analysis of the same data augmented with a considerable amount of additional data; this agreement indicates that valid conclusions may be obtained from smaller data sets when regression methods are applied to the rank-transformed data. ERA

N78-30885# Loughborough Univ. of Technology (England). Dept. of Mathematics.
A SYSTEMATIC METHOD OF ESTIMATING GAPS IN THE ESSENTIAL SPECTRUM OF SELF-ADJOINT OPERATORS
B. J. Harris Sep. 1977 29 p refs
(MATHS-Res-117) Avail: NTIS HC A03/MF A01

Estimates for the length, l(mu), of a gap center mu in the essential spectrum associated with a first order differential system are given. Estimates which are uniform in mu and also estimates of the form l(mu) = O(/mu/ to the -k power), l(mu) = O(/mu/ to the -k power) for /mu/ sufficiently large where k is a positive integer which increases with increasing differentiability of the coefficients, are obtained. The uniform estimates extend some results obtained by Weidmann whilst the asymptotic results are similar to some obtained for a scalar differential equation by Eastham. Both types of result are obtained by an algorithmic method. Author (ESA)

N78-30886# Loughborough Univ. of Technology (England). Dept. of Mathematics.
GAPS IN THE ESSENTIAL SPECTRA OF SCHROEDINGER AND DIRAC OPERATORS
B. J. Harris Nov. 1977 25 p refs
(MATHS-Res-121) Avail: NTIS HC A02/MF A01

A systematic method of estimating the length of gaps in the essential spectrum of a self-adjoint operator generated by an ordinary differential system was investigated. It is shown how the same techniques may be employed to estimate the length of gaps in the essential spectra of Dirac and Schroedinger operators. Means of adapting this method in order to obtain the results deduced by Eastham for a self-adjoint operator generated by a second order scalar differential equation were investigated. Author (ESA)

N78-30887# National Geodetic Survey, Rockville, Md.
APPLICABILITY OF ARRAY ALGEBRA
Richard A. Snay Feb. 1978 28 p refs
(PB-281196/6; NOAA-TM-NOS-NGS-11; NOAA-78041201)
Avail: NTIS HC A03/MF A01 CSCL 12A

Matrix equations associated with gridded data reduce to equivalent array equations, with proper assumptions for the mathematical model and the weight matrix. Array equations involve significantly fewer computations and less computer storage than the equivalent matrix equations. Fields in which array algebra has found application include satellite imagery terrain modeling, and photogrammetry. GRA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N78-30888*# Houston Univ., Tex. Dept. of Mathematics.
FEATURE SELECTION FOR BEST MEAN SQUARE APPROXIMATION OF CLASS DENSITIES
Charles Peters Jul. 1978 12 p refs
(Contract NAS9-15000)
(NASA-CR-151823; Rept-71) Avail: NTIS HC A02/MF A01 CSCL 12A

A criterion for linear feature selection is proposed which is based on mean square apporximation of class density functions. It is shown that for the widest possible class of approximants, the criterion reduces to Devijver's Bayesian distance. For linear approximants the criterion is equivalent to well known generalized Fisher criteria. Author

N78-30889*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STOCHASTIC PROCESSES, ESTIMATION THEORY AND IMAGE ENHANCEMENT
Touraj Assefi Jun. 1978 265 p refs
(Contract NAS7-100)
(NASA-CR-157561; JPL-Pub-78-50) Avail: NTIS HC A12/MF A01 CSCL 12A

An introductory account of stochastic processes, estimation theory, and image enhancement is presented. The book is primarily intended for first-year graduate students and practicing engineers and scientists whose work requires an acquaintance with the theory. Fundamental concepts of probability were reviewed that are required to support the main topics. The appendices discuss the remaining mathematical background.G.G.

N78-30890# Stanford Univ., Calif. Dept. of Operations Research.
VARIANCE REDUCTION TECHNIQUES FOR SIMULATING MARKOV CHAINS
Philip Heidelberger Sep. 1977 8 p refs Presented at the 1977 Winter Simulation Conf., Gaithersburg, Md., 5-7 Dec. 1977; Sponsored by NBS
(Contract N00014-76-C-0578; Grant NSF MCS-75-23607)
(AD-A054274; SU-TR-41) Avail: NTIS HC A02/MF A01 CSCL 12/1

Simulators frequently wish to estimate parameters of the limiting distribution of stable stochastic processes. Several new methods for reducing the variance of such estimates will be proposed and discussed. The methods are applicable to regenerative Markov processes in both discrete and continuous time as well as to semi-Markov processes. The methods are similar to the technique of multiple control variables yet differ in the important respect that it is not necessary to calculate the means of the controls. This is because the controls are chosen in such a way that their means actually equal the parameter of interest. The methods do require a certain amount of computation to be done before the simulation begins, although their cost should be relatively minor compared with that of the simulation. Numerical results demonstrating the effectiveness of the techniques for a simple queueing model are presented. Author (GRA)

N78-30891# North Carolina Univ. at Chapel Hill. Inst. of Statistics.
TEST FOR FINITE MIXTURES OF DISTRIBUTIONS
Apr. 1977 96 p refs
(Contract DAAG29-74-C-0030)
(AD-A054746; MIMEO-SER-1122; ARO-11959.20-M) Avail: NTIS HC A05/MF A01 CSCL 12/1

The properties of three approaches to test the hypothesis of finite proper mixtures of distributions are discussed. Two of them are compared for the case of two normal components against a single normal alternative. The third is investigated by simulation studies. Author (GRA)

N78-30892# Defence Research Establishment Pacific, Victoria (British Columbia).
THE ASYMPTOTIC RELATIVE EFFICIENCY OF VARIOUS NONPARAMETRIC DETECTORS USED ON SPECTRAL DATA
M. J. Wilmut and R. F. MacKinnon Dec. 1977 15 p refs
(AD-A054937; DREP-TM-77-13) Avail: NTIS HC A02/MF A01 CSCL 12/1

Asymptotic relative efficiency (ARE) and asymptotic loss are two ways to compare the performance of one detector to another and in particular to the optimum detector. Various authors have suggested and studied a variety of nonparametric detection schemes applicable in the analysis of spectral data. Here we derive the ARE's of the modified Savage detector and Sc set of detectors. It is shown that in most cases of practical interest the ARE of the modified Savage detector is higher than that of the Mann-Whitney detector. The asymptotic loss of the modified Savage detector with respect to the optimum detector in these cases is less than 1 dB. Author (GRA)

N78-30893# Loughborough Univ. of Technology (England). Dept. of Mathematics.
ASYMPTOTIC DISTRIBUTION OF THE CRAMER-VON MISES STATISTIC WHEN TESTING FOR BIVARIATE NORMALITY
A. N. Pettitt May 1977 18 p refs
(MATHS-Res-110) Avail: NTIS HC A02/MF A01

Some general results concerning the eigenvalues of an homogeneous integral equation in two variables are given. These results are specialized to the case of finding the distribution of the Cramer-von Mises statistic when the null hypothesis is completely specified and when parameters have to be estimated when testing for bivariate normality. For this latter case, the asymptotic percentage points of the statistic are given. An example on the use of the statistics is also given. Author (ESA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N78-30894 Columbia Univ., New York.
COMPUTATIONAL METHODS IN LINEAR MULTIPLE OBJECTIVE OPTIMIZATION PROBLEMS WITH APPLICATIONS Ph.D. Thesis
Hwa Nien Shen 1978 214 p
Avail: Univ. Microfilms Order No. 7809927

Using the Pareto-optimality test developed, an algorithm is developed to systematically obtain the set of all Pareto-optimal solutions. The algorithm is divided into four parts. In the first part, an oriented graph describing the constraint set is generated. The second part deletes those vertices and edges in the constraint set that are nonPareto-optimal. The third part determines the subsets of Pareto-optimal solutions. In obtaining these subsets of Pareto-optimal solutions, the theory of alternative paths is presented. The last part determines the set of all Pareto-optimal solutions. A modified algorithm using additional Pareto-optimality tests is also presented. In this algorithm, the Pareto-optimality of the vertices and edges in the constraint set is checked as the graph describing the constraints set is determined. Because non of the nonPareto-optimal vertices and edges are retained, substantial savings in computer storage can be achieved. Dissert. Abstr.

N78-30895 Cornell Univ., Ithaca, N. Y.
INTEGRAL NEAR-OPTIMAL SOLUTIONS TO CERTAIN CLASSES OF LINEAR PROGRAMMING PROBLEMS Ph.D. Thesis
Steven Paul Baum 1978 93 p
Avail: Univ. Microfilms Order No. 7809787

The relation between optimal rational solutions and optimal integral solutions for several classes of linear programming problems are examined. This relationship depends in various ways on total unimodularity of certain matrices. Several relevant examples from the literature of combinatorial optimization, including network flows, matroid intersections, matchings, bipartite graphs and balanced matrices, are discussed from a viewpoint which emphasizes the role of total unimodularity. Results are given for linear programming problems arising from polymatroids, the intersection of two strongly base-orderable matroids, branchings, totally unimodula matrices and the scheduling of precedence related unit execution time jobs on independent identical machines. Strong integral min-max and max-min theorems are derived for certain of the programming problems considered. Dissert. Abstr.

N78-30896*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROCEDURES FOR GENERATION AND REDUCTION OF LINEAR MODELS OF A TURBOFAN ENGINE
Kurt Seldner and David S. Cwynar Aug. 1978 45 p refs
(NASA-TP-1261; E-9460) Avail: NTIS HC A03/MF A01 CSCL 12B

A real time hybrid simulation of the Pratt & Whitney F100-PW-F100 turbofan engine was used for linear-model generation. The linear models were used to analyze the effect of disturbances about an operating point on the dynamic performance of the engine. A procedure that disturbs, samples, and records the state and control variables was developed. For large systems, such as the F100 engine, the state vector is large and may contain high-frequency information not required for control. This, reducing the full-state to a reduced-order model may be a practicable approach to simplifying the control design. A reduction technique was developed to generate reduced-order models. Selected linear and nonlinear output responses to exhaust-nozzle area and main-burner fuel flow disturbances are presented for comparison. Author

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N78-30897 California Univ., Los Angeles.
OPTIMIZATION PROBLEMS INVOLVING SET FUNCTIONS Ph.D. Thesis
Robert John Tasman Morris 1978 104 p
Avail: Univ. Microfilms Order No. 78-11369

Problems involving optimal selection of a subset from a certain space arise naturally in many applications. Much of the existing optimization theory is directed towards the case where a decision is regarded as a point in a linear vector space, and is, therefore, not applicable. The problem considered is formulated. Some

simple examples are used to illustrate how problems arise and explain the choice of the formulation. For a class of additive set functions, necessary, sufficient, existence and uniqueness conditions for optimality are given. Where the set functions are nonadditive, two different approaches are developed. It is shown that for a commonly occurring class of set functions, the optimization problem reduces to a fixed problem in Euclidean space. Dissert. Abstr.

N78-30898# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
CONNECTED LEVEL SETS, MINIMIZING SETS, AND UNIQUENESS IN OPTIMIZATION, PART 1
D. H. Martin Sep. 1977 18 p refs
(CSIR-SR-WISK-276-Pt-1; ISBN-0-7988-1201-X) Avail: NTIS HC A02/MF A01

The intimate relationships are investigated between connectedness properties of the lower level sets of a real function f on a topological space X, and the uniqueness of minimizers for f. The concepts are introduced of critical sets and minimizing sets, which are required to be connected components, on which f is constant, of some lower level set. The principal result is that a function with compact lower level sets on a Hausdorff space has a unique global minimizing set and no other local minimizing set if and only if all of its lower level sets are connected. Author

N78-30899# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
CONNECTED LEVEL SETS, MINIMIZING SETS AND UNIQUENESS IN OPTIMIZATION, PART 2
D. H. Martin Oct. 1977 20 p refs
(CSIR-SR-WISK-277-Pt-2; ISBN-0-7988-1201-X) Avail: NTIS HC A02/MF A01

This study complements the writer's first paper under the same title, and introduces an alternative notion of critical set for f, called an LT-critical set. Unlike an LE-critical ser, an LT-critical set need not be connected, but is required to be a maximal subset of X on which f is constant and which is contained in a single connected component of each higher strict level set. This definition results immediately in a uniqueness theorem for functions having connected strict level sets. For functions having compact level sets on Hausdorff spaces, it is proved that the two theories are equivalent, and the converse uniqueness theorem holds. Finally it is shown that functions with connected strict level sets arise naturally in parametric programming problems with quasiconvex objective function and linear constraints. Author

N78-30900# Loughborough Univ. of Technology (England). Dept. of Mathematics.
EQUIVALENCE OF A MATRIX OVER Rz WITH ITS SMITH FORM
M. G. Frost (Trent Polytech., Nottingham) Jun. 1977 28 p refs
(MATHS-Res-112) Avail: NTIS HC A03/MF A01

The equivalence of a matrix Rs,z with its Smith form and the corresponding effect on the equivalence of two matrices over Rs,z were investigated. The concept of zeros of a matrix over Rs,z was introduced and was found to play an important part in the above investigations. Some results concerning system matrices over Rs,z are given along with three conjectures concerning such matrices. Author (ESA)

N78-30901# Loughborough Univ. of Technology (England). Dept. of Mathematics.
TRANSFORMATIONS OF SYSTEM SIMILARITY BETWEEN STATE-SPACE SYSTEM MATRICES OVER Rs,z
M. G. Frost (Trent Polytech., Nottingham) and C. Storey Nov. 1977 17 p refs
(MATHS-Res-119) Avail: NTIS HC A02/MF A01

Matrices over Rs,z which are extensions of the usual form of state-space system matrices over Rs,z were considered, the main object being to investigate under what conditions such matrices are system similar over Rz. It was found that these conditions involve not only the concept of decoupling factors of a system matrix over Rs,z but also the new concept of decoupling zeros of such a system matrix. The connection of these decoupling zeros for a given system matrix with the corresponding transfer function matrix was also examined. Author (ESA)

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N78-30902# Oak Ridge National Lab., Tenn.
TIME-DEPENDENT HARTREE-FOCK THEORY IN A TWO-DIMENSIONAL ROTATING FRAME
H. T. Feldmeier Oct. 1977 19 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6053) Avail: NTIS HC A02/MF A01

From a variational principle, which is equivalent to Schroedinger's equation, equations are derived which allow for the description of a system of axial symmetry rotating around an axis perpendicular to the symmetry axis. Expressions are given for the moment of inertia, the angular velocity, and the contribution of the rotational energy to the total kinetic energy. ERA

N78-30903# National Technical Information Service, Springfield, Va.
COBALT RARE EARTH PERMANENT MAGNETS. CITATIONS FROM THE NTIS DATA BASE Final Report, 1964 - May 1978
Mona F. Smith Jun. 1978 148 p Supersedes NTIS/PS-77/0443; NTIS/PS-76/0281
(NTIS/PS-78/0518/7; NTIS/PS-77/0443; NTIS/PS-76/0281) Avail: NTIS HC $28.00/MF $28.00 CSCL 20L

Federally-funded research on fabrication, crystal growth, crystal structure, defects, tests, measurement, and magnetic and thermal properties are cited. Studies on phase transformations, intermetallic compounds, magnetization, anisotropy, surface properties, performance, and applications are included. (This updated bibliography contains 142 abstracts, 12 of which are new entries to the previous edition.) GRA

N78-30904# National Technical Information Service, Springfield, Va.
COBALT RARE EARTH PERMANENT MAGNETS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Final Report, 1970 - May 1978
Mona F. Smith Jun. 1978 233 p Supersedes NTIS/PS-77/0444
(NTIS/PS-78/0519/5; NTIS/PS-77/0444) Avail: NTIS HC $28.00/MF $28.00 CSCL 20L

Research summaries from worldwide journals on fabrication, composition, bonding, sintering, pressing, and processing of these magnets are presented. Studies on phase transformations, microstructure, intermetallic compounds, and anisotropy are covered. The efficiency of electric motors traveling wave tubes, microwave equipment and magnetic tape drives using cobalt rare earth magnets is included. (This updated bibliography contains 226 abstracts, 48 of which are new entries to the previous edition.)

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N78-30905# Naval Ocean Systems Center, San Diego, Calif.
ACOUSTIC REFLECTION FROM A THICK PLATE WITH ONE REINFORCING RIB. EXACT INTEGRAL EVALUATION IS PROVED SUPERIOR TO INTEGRAL APPROXIMATION IN ANALYSIS OF ACOUSTIC REFLECTIONS FROM A TIMOSHENKO-MINDLIN PLATE REINFORCED WITH ONE RIB
Interim Report, Fiscal Year 1977
Barry L. Woolley Dec. 1977 101 p
(AD-A054610; NOSC/TR-176) Avail: NTIS HC A06/MF A01 CSCL 20/1

The reflection of a plane sound wave from a thick, i.e., Timoshenko-Mindlin, fluid-loaded elastic plate reinforced with a stiffness member is investigated. The case is first solved without using integral approximation techniques. This solution gives relatively lower returns than those given by integral approximation techniques. The solution is also found by an integral approximation technique and then by an integral approximation technique taking into account leaky wave poles. The results of numerical calculations are presented and reviewed. Computer programs are given to carry out the calculations. GRA

N78-30906# Naval Ocean Systems Center, San Diego, Calif.
SOUND AMPLITUDE FLUCTUATIONS DUE TO INTERNAL TIDES Final Report, Oct. 1976 - Mar. 1977
P. A. Barakos 1 May 1978 15 p refs
(SF43452702)
(AD-A054609; NOSC/TR-119) Avail: NTIS HC A02/MF A01 CSCL 20/1

Large amplitude and phase fluctuations in underwater acoustic wave fields occur and are primarily due to the temporal and spatial variability of the water and its boundaries. The amplitude part of this phenomenon is investigated by obtaining simultaneously, time and space series of environmental and acoustic data from sensor arrays fixed in space, in shallow coastal water off California. The signal output from an ultrasonic source, mounted on a tripod three meters above the bottom, is monitored continuously by a hydrophone 150 meters away. The source radiates CW pulses at the repetition rate of one pulse per three seconds at 30 kHz. Time series of temperature from a vertical thermistor array, surface wave height, and the two horizontal components of water motion from an EM current meter are obtained. A sampling interval of three seconds was used. In continental shelf areas, the tidal force is frequently the principal driving mechanism giving rise to internal fluid oscillations of tidal period. Herein, the effect of 'internal tides' upon acoustic wave propagation is examined. A low pass numerical filter was used to reject all nontidal, high-frequency components from each of the time series. Vertical, time-dependent, sound-speed profiles were determined at hourly intervals. A ray optics technique is employed to clarify the interaction mechanism and good agreement is obtained between theoretical and experimental results.
Author (GRA)

N78-30907# Naval Research Lab., Washington, D. C.
A COMPUTERIZED AUTOMATIC MEASURING SYSTEM FOR CALIBRATION OF UNDERWATER SOUND TRANSDUCERS Final Report
Raymond F. Green and M. Odell Rhue 8 May 1978 74 p refs
(AD-A054895; NRL-8181) Avail: NTIS HC A04/MF A01 CSCL 20/1

This project was conceived to develop the hardware phase of a computerized electronic system that would provide computer-controlled measurements of underwater device parameters in the Anechoic Tank Facility (ATF) of the Naval Research Laboratory's Underwater Sound Reference Division (USRD). This electronic system operates in conjunction with USRD's new PDP-11/45 computer, remotely located in a Computer Center, to control the ATF system by software programming. This system enables an operator to communicate control parameters to the computer in simple English-language statements and to monitor and control the received signal gating during the measurement process. The major advantages realized with use of this computerized electronic system include, real-time analyses of the test transducer to resolve problem areas while the transducer is suspended in the tank under the imposed environmental conditions, recorded accurate and repeatable setup and control conditions for the measurements. Computerized data reduction that provides uniform report formats, and accurate measurements, previously unattainable, of load impedance wherein the voltage or current waveforms powering the test transducer are distorted. This system also has a completely manual mode or, via an integral acoustic coupler, which may communicate over a commercial telephone line with any remote computer. This hardware phase has been implemented in the ATF, and its effectiveness will continue to be analyzed relative to possible use in the other USRD measurement facilities. Author (GRA)

N78-30908# Atomics International Div., Golden, Colo. Rocky Flats Plant.
ACOUSTIC EMISSION FROM BERYLLIUM
C. R. Heiple and R. O. Adams 9 Jun. 1976 34 p refs
(Contract EY-76-C-04-3533)
(RFP-2504) Avail: NTIS HC A03/MF A01

The acoustic emission from both powder and ingot source beryllium has been measured as a function of strain and prior heat treatment. Most measurements were made during tensile deformation, but a limited number of compression tests have also been performed. The acoustic emission observed was of the burst type,with little or no contribution from continuous type emission. Burst rate maxima centered roughly at 0.1 percent and 1.0 percent plastic strain were observed. The magnitude but not the strain at the low strain burst rate peak was very sensitive to prior thermal treatment, while the higher strain burst rate peak was insensitive to prior heat treatment. An energy per burst maximum was observed at 0.2 percent plastic strain, the magnitude of which was moderately sensitive to heat treatment. The Kaiser effect is observed in the material studied. Emission during compression was similar to that observed in tension. The acoustic emission observed is attributed to dislocation motion. GRA

N78-30909# European Space Agency, Paris (France).
THEORETICAL AND EXPERIMENTAL STUDIES OF ACOUSTIC PROPAGATION IN INHOMOGENEOUS MOVING MEDIA
Sebastien Candel Jun. 1978 315 p refs Transl. into ENGLISH of 'Etudes Theoriques et Exptl. de la Propagation Acoustique en Milieu Inhomogene et en Mouvement', ONERA, Paris Report ONERA-P-1977-1, 1977 Original report in FRENCH previously announced as N78-24905
(ESA-TT-477; ONERA-P-1977-1) Avail: NTIS HC A14/MF A01

Three problems are treated in particular: the propagation of plane and modal pressure waves in nozzles and diffusers, the adiation of the jet noise high-frequency components, and the propagation of an acoustic field in the free flow of an open wind tunnel. A numerical algorithm based on the geometrical approximation was developed and allows the calculation of the wave field (amplitude and phase) in the case of very general media (inhomogeneous, dispersive, including reflecting surfaces). A comparison between calculations and experimental results obtained in an open wind tunnel was made to check the proposed numerical method and to demonstrate its practical utility.
Author (ESA)

N78-30910# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
A FURTHER SURVEY OF SOME EFFECTS OF AIRCRAFT NOISE IN RESIDENTIAL COMMUNITIES NEAR LONDON (HEATHROW) AIRPORT
J. B. Ollerhead and R. M. Edwards Jun. 1977 148 p refs
(Contract SN/1170/012)
(TT-7705) Avail: NTIS HC A07/MF A01

Six hundred residents of suburban communities near London (Heathrow) airport were interviewed in a pilot survey designed to compare alternative methods of scaling aircraft noise exposure and human reactions to it. The various associations between noise variables is discussed. It is concluded that no new noise scale is likely to emerge which is a more reliable or convenient predictor of aircraft noise annoyance than Noise and Number Index (NNI). ESA

N78-30911# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
A COMPARISON OF ANNOYANCE CAUSED BY AIRCRAFT NOISE NEAR LONDON, MANCHESTER AND LIVERPOOL AIRPORTS
J. B. Ollerhead Jun. 1977 77 p refs
(Contract SN/1170/012)
(TT-7706) Avail: NTIS HC A05/MF A01

In a postal survey designed to investigate the validity of Noise and Number Index (NNI) for scaling aircraft noise impact at airports other than London (Heathrow), questionnaires were sent simultaneously to some 3000 residents near London (Heathrow), Manchester and Liverpool airports. Although the

response rate was poor, the results indicate that NNI is one of several noise scales which show optimum correlation with annoyance reactions. However, the mean reactions differed between airports with Manchester residents being slightly more sensitive and Liverpool residents significantly less sensitive to a given amount of aircraft noise than their Heathrow counterparts. It is recommended that rather than perform more surveys to identify an optimum noise scale, a suitable, convenient scale be standardized and that the primary objective of future surveys should be to establish the relevant dose-response relations. An important step in this direction would be the development of a general procedure for the measurement of noise annoyance.

Author (ESA)

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N78-30912 Columbia Univ., New York.
VIBRATIONAL STEADY STATES PRODUCED BY THE VIBRATIONAL RELAXATION OF LASER PUMPED POLYATOMIC MOLECULES Ph.D. Thesis
Irwin Leon Shamah 1978 256 p
Avail: Univ. Microfilms Order No. 7811153

Translational energy changes accompanying laser induced V-V equilibration processes in CH3F/O2 and CH3F/Ar mixtures were studied using the time resolved thermal lensing technique. Enhanced translational cooling in CH3F/O2 mixtures relative to equivalent CH3F/Ar mixtures was observed. A model is proposed to describe the vibrational steady state in a laser pumped polyatomic gas. Such systems are shown to be characterized by a multiple temperature distribution with temperature relationships governed by the vibrational energy transfer pathway. Examples of multiple temperature distributions are presented for laser pumped CH3F undergoing various relaxation pathways and at a variety of initial conditions. The energy distribution following from the calculated temperature distribution is presented for laser pumped CH3F undergoing the suggested endothermic energy transfer pathway. Dissert. Abstr.

N78-30913 Vanderbilt Univ., Nashville, Tenn.
SIMULATION OF EPR SPECTRA OF NITROXIDE SPIN LABELS IN THE RIGID LATTICE LIMIT. 1. SOURCE MODULATION IN EPR SPECTROSCOPY-SENSITIVITY OF SIGNALS TO MOLECULAR REORIENTATION, 2 Ph.D. Thesis
K. Balasubramanian 1977 74 p
Avail: Univ. Microfilms Order No. 7812405

A rapid computer program is developed for simulating X and Q band EPR spectra of (14)N nitroxide spin labels in the rigid lattice limit. The sensity matrix formalism in which the interaction of the spin system with all time dependent applied modulation and microwave fields is explicity included is employed in the lineshape calculations. The effect of neglecting pseudosecular terms on spectra simulations is demonstrated. Extensions of the computer program to simulate effects due to rapid anisotropic motion of the spin label are indicated. The effect of modulating the amplitude of the microwave source instead of the Zeeman magnetic field is theoretically investigated. The sensitivity of source modulated signals to molecular reorientation is mapped out for isotropic Brownian diffusion. Spectra at various rotational correlation times are simulated by a Transition Rate Matrix approach, employing the difference approximation to the motional operator for isotropic rotational diffusion. Dissert. Abstr.

N78-30914 Stanford Univ., Calif.
ACCURATE PROPERTIES OF SMALL ATOMS AND MOLECULES Ph.D. Thesis
Rodger Murray Glover 1978 329 p
Avail: Univ. Microfilms Order No. 7814226

Rigorous bounding procedures were developed for the dynamic polarizability at real and imaginary frequencies, which are valid even when the field-free problem cannot be solved exactly. These methods have been applied to calculate bounds to dynamic polarizabilities at real frequencies for two-electron atoms. For the polarizability at imaginary frequencies, the bounds provide rigorous limits to the van der Waals coefficients of dispersion interaction through the Casimir-Polder formulas. A set of general programs was written to carry out a wide variety of accurate quantum-mechanical calculations on two-electron diatomic systems employing a correlated basis set. The programs have been applied in the calculation of the Born-Oppenheimer potential-energy curve for the 3D + 3K state of the hydrogen molecule using a twenty-term basis set. Dissert. Abstr.

N78-30915 California Univ., Berkeley.
THE INTERACTION OF RARE GAS METASTABLE ATOMS Ph.D. Thesis
Andrew Zun-Foh Wang 1977 263 p
Avail: Univ. Microfilms Order No. 7812814

The physical and chemical properties of metastable rare gas atoms are discussed and summarized. This is followed by a detailed examination of the various possible pathways whereby the metastable's excess electronic energy can be dissipated. The phenomenon of chemi-ionization is given special emphasis, and a theoretical treatment based on the use of complex (optical) potential is presented. A discussion is given on the unique advantages offered by elastic differential cross section measurements in the apprehension of the fundamental forces governing the ionization process. The methodology generally adopted to extract information about the interaction potential from scattering data is also systematicaly outlined. Two widely studied chemi-ionization systems are then closely examined in the light of accurate differential cross section measurements obtained in this work. Dissert. Abstr.

N78-30916 California Univ., Berkeley.
CHEMICAL APPLICATIONS OF MOLECULAR QUANTUM THEORY Ph.D. Thesis
Steven Ray Ungemach 1977 158 p
Avail: Univ. Microfilms Order No. 7812804

The self-consistent field (SCF) method was used to predict the molecular structures of ClF2, ClF4 and Cl3 radicals, and positive and negative ClF2 and ClF4 ions. The ClF2 and Cl3 radicals are predicted to be bent with bond angles of 145.2 deg and 158.6 deg, respectively, while the ClF2 positive negative ions are predicted to be bent with a bond angle of 97.4 deg and linear, respectively. The geometry predictions for the radical and the ClF4 positive ion are found to be notably basis set dependent. The ClF4 ion is predicted to be square-planar. The simplest hydrophobic model, the water-methane system, is studied with the SCF method in order to determine the nature and magnitude of the interaction. The most favorable geometric arrangement corresponds to an attraction of 0.5 kcal/mole.

Dissert. Abstr.

N78-30917 Purdue Univ., Lafayette, Ind.
SOME ASPECTS OF PROTON-PROTON INTERACTIONS AT 28.5 GEV/C AS VIEWED FROM THE STATISTICAL-HYDRODYNAMICAL THEORY Ph.D. Thesis
Carl Robin Ezell 1977 91 p
Avail: Univ. Microfilms Order No. 7813054

The momentum distribution of positive and negative pions normal to the production plane is studied. The dispersion of the momentum distribution normal to the production plane is independent of the transverse momenta of the trigger protons. The transverse-momentum distribution of charged pions was studied. Scaling of the transverse-momentum distribution versus the mean variable P sub t/less than P greater than sub T was observed, independent of charge multiplicity, missing mass, and energy, in the central region. From the scaling behavior of the pions, the limiting temperature was determined to be t sub o = 117 + or - 4 MeV. The ratio of negative pion pairs to that of negative-positive pion pairs as function of the Kopylov variables has been measured. A correlation was observed. From the shape of the correlation function we determined the radius r and lifetime l of the centrally produced hadronic matter parallel and perpendicular to the collision axis. Dissert. Abstr.

N78-30918 Notre Dame Univ., Ind.
A STUDY OF RESONANCE AND NEUTRAL PARTICLE

PRODUCTION IN HIGH ENERGY PI NEGATIVE PION-PROTON INTERACTIONS Ph.D. Thesis
Patrick Dennis Higgins 1978 190 p
Avail: Univ. Microfilms Order No. 78-13579

Properties of resonant and neutral particle production in 360 GeV/c negative pion proton interactions and resonant particle production in negative pion proton data taken from 100 and 200 GeV/c experiments were studied. Production cross sections are discussed for the delta ++ (1232) and neutral lambda (1115) baryons, for the netral lambda (1115) anti-baryon, and for the K (498), rho (770) and pi (135) neutral mesons. Dissert. Abstr.

N78-30919# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
EQUILIBRIUM OF IONIC RINGS [EQUILIBRIO DE ANEIS IONICOS]
Gerson Otto Ludwig Mar. 1978 48 p refs In PORTUGUESE; ENGLISH summary Submitted for publication
(INPE-1205-PE/116) Avail: NTIS HC A03/MF A01

The equations which describe the azimuthally symmetric equilibrium of a system of charged particles in an external magnetic field are studied. In particular, attention is focused on the rigid-rotor type of diamagnetic equilibrium. The solutions of these equations are discussed, in one and two dimensions, for ion rings in isothermal and in adiabatic equilibrium states. Author

N78-30920# Cornell Univ., Ithaca, N. Y.
DYNAMICS OF THE CHEMISTRY OF ELECTRONICALLY EXCITED ATOMS IN DEFINED QUANTUM STATES Annual Summary Report, 1 Apr. 1977 - 31 Mar. 1978
John R. Wiesenfeld 1 May 1978 27 p refs
(Contract N00014-75-C-0828)
(AD-A054257) Avail: NTIS HC A03/MF A01 CSCL 20/8

The research program described in this report is concerned with the study of the chemistry of electronically excited halogen atoms in the gas phase. These atomic species are interesting not only in terms of developing model systems for understanding the general chemistry of electronically excited atoms, but also because of their importance in the fields of laser isotope separation and chemical laser development. In essence, this research concerns itself with the elucidation of the role of electronic energy in affecting the chemistry or photochemistry of excited halogen atoms and molecules. While much is known about the dynamics of chemical and physical processes which are carried out on the lowest potential energy hypersurface correlating with reactants and products in their electronic ground state, relatively little is known about the dynamics of such phenomena as energy transfer and chemical reactivity on higher-lying potential hypersurfaces. GRA

N78-30921# Oak Ridge National Lab., Tenn. Neutron Physics Div.
CODE PERTUBAT FOR PROCESSING NEUTRON DIFFUSION THEORY NEUTRONICS RESULTS FOR PERTURBATION ANALYSES
D. R. Vondy and T. B. Fowler Mar. 1978 88 p refs
(Contract W-7405-eng-26)
(ORNL-5376) Avail: NTIS HC A05/MF A01

The PERTUBAT code is a module in the local computation system which contains the VENTURE neutronics code for applying multigroup diffusion theory. First order effects are calculated for changes in macroscopic cross sections. These may be due to changes in nuclide densities and microscopic cross sections. A fractional change may be made in macroscopic cross sections or the effects of temperature changes may be accounted for directly given the temperature distributions and associated cross section data. Regular, adjoint flux integrals are made available for other use. These integrals and the perturbations may be obtained for selected conditions with multiple sets of the reference data files available in the run of the modular code system. Thus the regular flux may be generated for a reference state, the adjoint flux for a specific perturbed state, and the individual components to the net reactivity change may be obtained for the change between the two states in this computation system. ERA

N78-30922# Stanford Linear Accelerator Center, Calif.
CHARMED PARTICLE SPECTROSCOPY
G. J. Feldman Dec. 1977 50 p refs Lectures given at the Banff Summer Inst. on Particles and Fields, Can., 26 Aug. - 3 Sep. 1977
(Contract EY-76-S-03-0326)
(SLAC-PUB-2068) Avail: NTIS HC A03/MF A01

Lectures are presented in a review of the properties of charmed particles in the time since their definitive identification. The emphasis is on the recent work on D resonance decay, mass, and absolute branching ratio as determined from the decays of the psi (3772). Also the total hadronic cross section, spin and parity determinations, D(0) - D(-0) mixing, and F mesons and charmed baryons are considered. ERA

N78-30923# Argonne National Lab., Ill.
THEORY OF SPIN DEPENDENCE AT VERY HIGH ENERGIES
G. H. Thomas 1977 14 p refs Presented at Workshop on Possibilities for Higher Energy Polarized Proton Beams, Ann Arbor, Mich., 18-27 Oct. 1977
(Contract W-31-109-eng-38)
(ANL-HEP-CP-78-04; Conf-7710115-2) Avail: NTIS HC A02/MF A01

Some of the theoretical expectations for polarization phenomena are reviewed assuming that hadrons are composite. Polarization phenomena are considered from an S-matrix point of view. ERA

N78-30924# Stanford Linear Accelerator Center, Calif.
HADRON SPECTROSCOPY AND THE NEW PARTICLES
F. J. Gilman Dec. 1977 44 p refs Presented at the Banff Summer Inst. on Particles and Fields, Alberta, Canada 26 Aug. 1977 - 3 Sep. 1977
(Contract EY-76-S-03-0326)
(SLAC-PUB-2065; Conf-770889-1) Avail: NTIS HC A03/MF A01

Various properties of the new particles are discussed and the related theories considered. The quark model, mesons, baryons, and decay processes are treated. ERA

N78-30925# Stanford Linear Accelerator Center, Calif.
COMPOSITE HADRONS AND RELATIVISTIC NUCLEI
R. Blankenbecler Jan. 1978 69 p Lecture presented at Tubingen Univ., Germany, Jun. 1977
(Contract EY-76-S-03-0326)
(SLAC-PUB-2077) Avail: NTIS HC A04/MF A01

Lectures are presented describing a model of hadronic scattering at large momentum transfer, either transverse or longitudinal. This model emphasizes in this regime the importance of forces involving the interchange of constituents of the hadrons, hence its name, the constituent interchange model CIM. The CIM is a rearrangement of standard perturbation theory to take into account the fact that the binding force is very strong in color singlet states (singlet dominance). The subjects studied are (1) hard scattering expansion, (2) incoherence problems, (3) nuclear wave functions and counting rules, (4) interaction between nuclei, (5) pion and proton yields and form factors, (6) structure functions and nonscaling, (7) massive lepton pairs, (8) hadrons at large transverse momentum, and (9) quark-quark scattering. ERA

N78-30926# Argonne National Lab., Ill.
ONE PHOTON EXCHANGE PROCESSES AND THE CALIBRATION OF POLARIZATION OF HIGH ENERGY PROTONS
B. Margolis (McGill Univ., Montreal, Quebec) and G. H. Thomas Jan. 1978 7 p refs Presented at the Workshop on Possibilities for High Energy Polarized Proton Beams, Ann Arbor, Mich., 18-27 Oct. 1977 Sponsored in part by The National Research Council of Canada, The Quebec Dept. of Education
(Contract W-31-109-eng-38)
(ANL-HEP-CP-78-03; Conf-7710115-3) Avail: NTIS HC A02/MF A01

Polarization phenomena in small momentum transfer high energy one-photon exchange processes in the reaction p+ A = X + A where A is a complex nucleus and X is anything, are examined. It is shown that these polarizations can be related directly to photoproduction polarization effects in the reaction gamma + p = X at low energies. Explicit formulae are written

for polarization effects in the case where X = pi superscript o + p. ERA

N78-30927# California Univ., Livermore. Lawrence Livermore Lab.
INTEGRATED SYSTEM FOR PRODUCTION OF NEUTRONICS AND PHOTONICS CALCULATIONAL CONSTANTS. VOLUME 5, PART B: RELATIVISTIC TRANSFORMATIONS BETWEEN CENTER-OF-MASS AND LABORATORY SYSTEMS FOR TWO-BODY NUCLEAR REACTIONS
R. J. Howerton 16 Jan. 1978 19 p
(Contract W-7405-eng-48)
(UCRL-50400-Vol-5-Pt-B) Avail: NTIS HC A02/MF A01

A technique is described for transforming cross sections and secondary-particle energies between center-of-mass and laboratory systems for two-body nuclear reactions. The derivations of the relativistic transformations needed for this technique are also reviewed. ERA

N78-30928# Oak Ridge National Lab., Tenn. Neutron Physics Div.
CALCULATED HADRONIC TRANSMISSION THROUGH IRON ABSORBERS
T. A. Gabriel and B. L. Bishop Mar. 1978 45 p refs Submitted for publication
(Contract W-7405-eng-26)
(ORNL/TM-6132) Avail: NTIS HC A03/MF A01

The transmission of hadrons through iron absorbers is investigated for a variety of experimental configurations, and incident particle types (protons, and charged pions) and energies (o.8 GeV/c to 100 GeV). The results obtained are consistent with available experimental data. ERA

N78-30929# National Academy of Sciences - National Research Council, Washington, D. C.
NEUTRON RESEARCH ON CONDENSED MATTER: A STUDY OF THE FACILITIES AND SCIENTIFIC OPPORTUNITIES IN THE UNITED STATES
1977 166 p
(Contract EY-76-C-02-2708-014)
(COO-2708-14-1) Avail: NTIS HC A08/MF A01

An in-depth review of the present status and future potential of the applications of low-energy neutron scattering to research in the condensed-matter sciences, including physics, chemistry, biology, and metallurgy is presented. The study shows that neutron scattering technology has proven to be of enormous importance to research in the above areas and especially to those of solid-state physics and chemistry. The main emphasis is on the scattering of low-energy neutrons by condensed matter. Since the same type of neutron source facilities can be used for the study of radiation damage, this related topic has also been included. ERA

N78-30930# Argonne National Lab., Ill.
CONDENSATION IN THE FEYNMAN-WILSON FLUID: UPSILON, PSI, AND CENTAURO
R. C. Arnold Sep. 1977 14 p refs
(Contract W-31-109-eng-38)
(ANL-HEP-PR-77-65) Avail: NTIS HC A02/MF A01

High multiplicity hadron production amplitudes with longrange rapidity correlations from Regge cuts can exhibit dramatic condensation phenomena in rapidity and charge variables. The rapidity structures would appear as metastable heavy hadrons such as Upsilon or Psi. Charge-space condensation (spontaneous symmetry breakdown) would produce phenomena resembling observed Centauro cosmic-ray events. The conditions necessary for appearance of such phenomena are linked to the conditions for generating electromagnetic and weak interactions through spontaneous strong-interaction symmetry breakdown. ERA

N78-30931# Maryland Univ., College Park.
INDEPENDENT PARTICLE SCHROEDINGER FLUID: MOMENTS OF INERTIA
K. K. Kan and J. J. Griffin Oct. 1977 104 p
(Contract EY-76-S-05-5126)
(ORO-5126-30) Avail: NTIS HC A06/MF A01

The single particle Schroedinger fluid philosophy is discussed and applied to the study of the moments of inertia of the independent fermion system. It is shown that three simplified systems exhibit the rigid-body rotational velocity field in the limit of large A, and that the leading deviations, both on the average and fluctuating, from this large A limit can be described analytically, and verified numerically. For a single particle in a Hill-Wheeler box, the moments are studied numerically, and their large fluctuations identified with the specific energy level degeneracies of its parallelepiped shape. The assemblage of new and old results is addressed to the question of the necessary and sufficient condition that the moment have the rigid value. Counterexamples are utilized to reject some conditions and the conjecture is argued that unconstrained shape equilibrium might be the necessary and sufficient condition. The spheroidal square well problem is identified as a promising test case. ERA

N78-30932# Oak Ridge National Lab., Tenn.
EFFECT OF THE ENERGY DEPENDENCE OF THE NEUTRON WIDTHS ON THE CALCULATION OF AVERAGE REACTION CROSS SECTIONS
F. C. Difilippo and R. B. Perez Dec. 1977 20 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5850) Avail: NTIS HC A02/MF A01

The validity of neglecting the energy dependence of the neutron width in the calculation of average reaction cross section is studied. ERA

N78-30933# Johns Hopkins Univ., Baltimore, Md. Dept. of Chemistry.
STUDIES IN HOT ATOM AND RADIATION CHEMISTRY Progress Report
W. S. Koski Sep. 1977 13 p refs
(Contract EY-76-S-02-3283)
(COO-3283-23) Avail: NTIS HC A02/MF A01

Investigations discussed include: (1) the reactive scattering of the reaction of the first excited state of C(+)(P-4) with molecular hydrogen in the energy range 0.5 eV to 9.0 eV; (2) reaction of the ground state C(+)(P-2) with D2 and H2 over the 2.5 eV to 28 eV energy range; (3) the vibrational structure in the energy spectrum of CH(+) and CD(+): (4) the product state in the reaction F(+)(H2,H)FH(+); (5) the Q/sub MIN for the reactions of F(+) with H2 and D2; (6) reactions of C1(+) (P-3,D-1) with D2 in the energy range 1 to 100 ev; and (7) energy transfer processes involving inelastic and superelastic collisions of Cl(+)(P-3) and Cl (D-1) with D2 and Ar. ERA

N78-30934# Montpellier Univ. (France). Dept. de Physique Mathematique.
THE OMEGA STAR - PHI STAR SYSTEMS: A LABORATORY FOR THE IIZUKA-ZWEIG-OKUBO RULE
F. M. Renard Feb. 1978 13 p refs
(PM/78/3) Avail: NTIS HC A02/MF A01

It is suggested to determine the origin of the violation of the IZO rule (annihilation diagrams or unitarity effects) from the study of the omega star to phi star interference in multipion production. Author (ESA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N78-30935# Brookhaven National Lab., Upton, N. Y.
VACUUM CONSIDERATIONS SUMMARY
D. Blechschmidt and H. J. Halama 1977 5 p refs Presented at Workshop on Heavy Ion Fusion, Upton, N. Y., 17-21 Oct. 1977
(Contract EY-76-C-02-0016)
(BNL-24029; Conf-771073-13) Avail: NTIS HC A02/MF A01

The vacuum system for heavy ion fusion machines can be divided according to pressure into 4 parts: (1) ion sources; (2) linear accelerators; (3) circular accelerators, accumulators and storage rings; and (4) reactors. Since ion sources need conven-

tional pumping arrangements and reactors operate with greater pressures, depending on their mode of operation, only items 2 and 3 are treated in this report. In particular, the vacuum system design for machines proposed by various scenarios is discussed. High mass numbers are assumed. ERA

N78-30936# California Univ., Berkeley. Lawrence Berkeley Lab.
BEAM BUNCHING IN A FINAL STORAGE RING
G. R. Lambertson 18 Nov. 1977 7 p Presented At Heavy Ion Fusion Workshop, Upton, New York, 17 Oct. 1977
(Contract W-7405-eng-48)
(LBL-7221; Conf-771093-3) Avail: NTIS HC A02/MF A01

A calculation is presented for the final bunching of a particle beam in a synchrotron or storage ring. The voltage per turn, the harmonic number, and the bunching time are obtained. ERA

N78-30937# California Univ., Berkeley. Lawrence Berkeley Lab.
ESTIMATES OF POST-ACCELERATION LONGITUDINAL BUNCH COMPRESSION
D. L. Judd 25 Nov. 1977 28 p Presented at Heavy Ion Fusion Workshop, Upton, New York, 17 Oct. 1977
(Contract W-7405-eng-48)
(LBL-7245; CONF-771073-4) Avail: NTIS HC A03/MF A01

A simple analytic method is developed, based on physical approximations, for treating transient implosive longitudinal compression of bunches of heavy ions in an accelerator system for ignition of inertial-confinement fusion pellet targets. Parametric dependences of attainable compressions and of beam path lengths and times during compression are indicated for ramped pulsed-gap lines, rf systems in storage and accumulator rings, and composite systems, including sections of free drift. It appears that for high-confidence pellets in a plant producing 1000 MW of electric power the needed pulse lengths cannot be obtained with rings alone unless an unreasonably large number of them are used, independent of choice of rf harmonic number. In contrast, pulsed-gap lines alone can meet this need. The effects of an initial inward compressive drift and of longitudinal emittance are included. ERA

N78-30938# Cincinnati Univ., Ohio.
INELASTIC STRONG INTERACTIONS AT HIGH ENERGIES Annual Progress Report, 1 Jun. 1977 - 31 May 1978
Peter Suranyi Feb. 1978 12 p refs
(Contract EY-76-S-02-2978)
(COO-2978-3) Avail: NTIS HC A02/MF A01

Certain classical solutions of the field equations, hereafter sectons, were shown to dominate inclusive and semi-inclusive cross sections which are proportional to the absolute square of the Fourier transform of these solutions in zeroth order of a model independent approximation scheme. Higher order approximations are obtained by the loop expansion method, or by a perturbation expansion around the classical solutions. Sectons were shown to be associated with nonvanishing values of two conserved topological quantum numbers (than vanish for solitons). An application to phi4 field theory gave an inclusive cross section with feynman scaling, a total cross section with a power dependence on the primary energy and a Poisson-like multiplicity distribution. An SU(2) invariant Reggeon field theory containing three reggeon multiplets, one with negative mass, was studied in the classical approximation with zero transverse dimensions. A solution was found, qualitatively similar to a solution of supercritical Pomeron theory, giving a constant local cross section and decreasing cross sections for quantum number exchanges. ERA

N78-30939# Atomics International, Canoga Park, Calif.
HELIUM GENERATION IN FUSION REACTOR MATERIALS Technical Progress Report, Apr. - Sep. 1977
31 Jan. 1978 41 p refs
(Contract EY-76-C-03-071-027)
(AI-DOE-13219) Avail: NTIS HC A03/MF A01

The near-term objectives of the program are to measure the spectrum-integrated helium generation rates and cross sections of a number of pure elements and alloys in several high-intensity neutron sources, and to develop and demonstrate neutron dosimetry procedures using some of these materials. To this end, four neutron irradiation experiments have now been run: one using accelerator-produced d-Be neutrons, two using the accelerator-produced d-T reaction, and one in the neutron field of a mixed-spectrum fission reactor. All of these irradiations have incorporated a large number of helium-generation materials. ERA

74 OPTICS

Includes light phenomena.

N78-30940# RCA Labs., Princeton, N. J.
GRANULAR OPTICAL MATERIALS Final Report, 1 Jan. 1975 - 31 Dec. 1977
J. Gittleman and E. K. Sichel 28 Feb. 1978 61 p refs
(Contract F44620-75-C-0057; AF Proj. 2306)
(AD-A054099; PRRL-78-CR-8; AFOSR-78-0714TR) Avail: NTIS HC A04/MF A01 CSCL 20/6

The research under this contract has been directed mainly toward the understanding of the optical behavior of those composite materials whose components are separated on a scale that is very small (- 100 A) compared with the wavelength of light. In the course of this work two types of new materials have been developed: (1) semiconductor-insulator composites which may be valuable as selective absorbers of solar radiation in solar thermal applications; and (2) electrochromic cermets which may have applications in a variety of display devices. Comparison of the predictions of two theories -- the Maxwell-Garnett theory (MG) and the effective-medium theory -- with the observed optical behavior of cermets formed by cosputtering a metal and an insulator clearly favored the MG theory. The optical properties of most Au, Ag, and W cermets were at least qualitatively described by MG, and good quantitative agreement could be obtained in most cases by modifying the published values of the optical constants of the metals to take into account the very short electron-scattering times found in the cermets. The most notable exception was Au-MgO, which did not exhibit the dielectric anomaly. GRA

N78-30941# California Univ., Livermore. Lawrence Livermore Lab.
HOW TO INTERPRET AN INTERFEROGRAM
Horst D. Bissinger 10 Nov. 1977 19 p Presented at Opt. Soc. of Am. Workshop on Opt. Fabric. and Testing, San Mateo, Calif., 10-12 Nov. 1977
(Contract W-7405-eng-48)
(UCRL-80300; Conf-771138-2) Avail: NTIS HC A02/MF A01

A method is presented of extracting three important parameters from a single set of interferograms. These parameters include surface flatness or transmitted wavefront distortions to determine maximum single-pass peak-to-valley distortions over the entire part in test, surface irregularities or gradient errors per centimeter over the clear aperture at normal incidence, and parallelism or wedge angle. This is accomplished by the use of any interferometer and simple hand tools. The analysis of the interferogram is described both experimentally and analytically. This technique is demonstrated for in-process testing by the optician or for final acceptance testing by the quality control inspector. ERA

N78-30942# West Virginia Geological Survey, Morgantown.
SOME PRACTICAL CONSIDERATIONS IN X-RADIOGRAPHY
John J. Renton Dec. 1977 37 p refs
(Contract EY-76-C-05-5199)
(MERC/SP-77/7) Avail: NTIS HC A03/MF A01

An X-radiograph is a photographic image of the preferential transmission (or absorption) of X-radiation by a solid object. However, obtaining high-quality, high-resolution radiographs requires a basic understanding of the process of radiography, and an optimization of a series of experimental parameters. This paper discusses the basic technique, discusses the experimental parameters and their relative effects, demonstrates the capabilities of X-radiography as an analytical technique, and includes an appendix of radiographs of Devonian shale material. ERA

N78-30943# National Engineering Lab., East Kilbride (Scotland).
AN OPTICAL SLIP-RING
D. G. Simpson and D. G. S. Lamb Jul. 1977 13 p refs
(NEL-640) Avail: NTIS HC A02/MF A01

A technique for the transmission of transducer signals from rotating mechanical components is described and its principle has been proven in a laboratory experimental model. It involves frequency modulating the intensity of infra-red light emitted from a series of solid state lamps (light emitting diodes) mounted on the rotation component. A stationary photodetector-lens system up to 1 m away receives the light emitted and the signal is demodulated by conventional means to yield the original transducer signal. A carrier frequency of 60 kHz was used.
Author (ESA)

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N78-30944*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LOW-FREQUENCY FLUCTUATION SPECTRA AND ASSOCIATED PARTICLE TRANSPORT IN THE NASA LEWIS BUMPY-TORUS PLASMA
Chandra M. Singh, Walter M. Krawczonek, J. Reece Roth, Jae Y. Hong (Texas Univ., Austin), Young C. Kim (Texas Univ.,Austin), and Edward J. Powers (Texas Univ., Austin) Aug. 1978 53 p refs
(NASA-TP-1258; E-9565) Avail: NTIS HC A04/MF A01 CSCL 20I

The strong radial electric field associated with the Penning discharge and the strong toroidal magnetic field give rise to a diversity of E/B phenomena, such as rotating waves and spokes, which in turn manifest themselves as space-time fluctuations of the plasma density and potential. Work is done to further understand the nature and origin of the fluctuations and their connection with fluctuation-induced transport. The approach is to monitor the density and potential fluctuations; to digitize the data; and to generate, with the aid of a computer, various spectral properties by means of the fast fourier transform. Of particular interest is the computer-generated transport spectrum that indicates in a quantitative way which fluctuation spectral components contribute to transport and which do not. All experimental measurements of the spectral characteristics of the plasma are given in absolute units rather than as relative values. Preliminary measurements of the transport spectrum of the ion population are given, and it is shown that the fluctuation-induced transport is in order-of-magnitude agreement with that inferred from the steady state current flowing to the electrodes that generate the plasma. L.S.

N78-30945# California Univ., Livermore. Lawrence Livermore Lab.
WAVE-PROPAGATION AND ENERGY-CONSERVATION CHECKS FOR ELECTRON-FLUID, RADIAL SUPERLAYER CODE
W. C. Condit 12 Dec. 1977 16 p refs
(Contract W-7405-eng-48)
(UCID-17683) Avail: NTIS HC A02/MF A01

A version of the SUPERLAYER code was modified to include the effect of plasma electrons treated as a massless fluid. This report describes tests of the code under input conditions that should guarantee the validity of the cold-plasma MHD wave solution described by Berk and Pearlstein. ERA

N78-30946# General Atomic Co., San Diego, Calif.
EMPIRICAL SCALING LAWS FOR ENERGY CONFINEMENT IN OHMICALLY-HEATED TOKAMAKS
W. W. Pfeiffer and R. E. Waltz Jan. 1978 59 p
(Contract EY-76-C-03-0167-038)
(GA-A-14727) Avail: NTIS HC A04/MF A01

The interpretation and empirical determination of scaling laws for Tokamak energy confinement are discussed. Special emphasis is given to the difficulty in determining the temperature dependence of the confinement time from ohmically-heated data. A large collection of ohmically-heated data is then presented. These data are analyzed statistically to obtain a temperature scaling and various confinement time scalings. Finally, the results are compared to previously proposed scalings. ERA

N78-30947# Los Alamos Scientific Lab., N. Mex.
SIMPLE MEASUREMENT OF LINE DENSITY
W. T. Armstrong (Colorado Univ., Boulder) and R. E. Siemon Feb. 1978 5 p refs
(Contract W-7405-eng-36)
(LA-7127-MS) Avail: NTIS HC A02/MF A01

Energy line density, E/sub 1/ = the integral of (F/2)nk(T/sub e/ + T/sub i/)dA, has proved to be one of the easiest (and most critical) measurements made on the Scylla IV-P, 5-m linear theta pinch. A quantitative evaluation of end-stoppering techniques is made available by extracting the line energy containment time, tau/sub E/sub 1//, from the time history of E/sub 1/. To model E/sub 1/(t) properly and, hence, determine the details of energy loss mechanisms (streaming and thermal conduction) requires separate measurements of n and T. A simple measurement of line density, n/sub 1/ = the integral of nd A, is proposed, in which a single laser beam is passed repeatedly through the plasma column along different chords. A discussion is presented of the measurement accuracy as a function of the number of passes. ERA

N78-30948# Princeton Univ., N. J. Plasma Physics Lab.
CHARGE-EXCHANGE MEASUREMENTS OF PARALLEL AND ANTI-PARALLEL ION TEMPERATURE PROFILES ON ATC
R. J. Goldston Mar. 1978 29 p refs
(Contract EY-76-C-02-3073)
(PPPL-1431) Avail: NTIS HC A03/MF A01

Measurements are described of the ion temperature profiles parallel and anti-parallel to the plasma current in the ATC Tokamak. The measurements were made using a single energy channel multi-sight-line neutral particle detector. The anti-parallel profile was found to be parabolic or somewhat broader, in accordance with expectation, while the parallel profile was nearly flat from the plasma center to within a few centimeters of the edge. This difference between the two profiles is interpreted as being due to neoclassical effects associated with large banana orbits. ERA

N78-30949# California Univ., Livermore. Lawrence Livermore Lab.
X-RAY LINES AS A DENSITY DIAGNOSTIC IN DT PLASMAS NEAR 100x SOLID DENSITY
David S. Bailey 19 Oct. 1977 12 p refs Presented at 19th Ann. Am. Phys. Soc. Meeting/Div. of Plasma Phys., Atlanta, 6-11 Nov. 1977
(Contract W-7405-eng-48)
(UCRL-79861; Conf-771136-28) Avail: NTIS HC A02/MF A01

The use of electron impact broadened resonance lines to diagnose near-term high density diagnostics is discussed. The selection of seed and pusher materials in order to have discernible broadening effects while maintaining line visibility is examined. ERA

N78-30950# California Univ., Livermore. Lawrence Livermore Lab.
TECHNOLOGY REQUIREMENTS FOR FUSION-FISSION REACTORS BASED ON MAGNETIC-MIRROR CONFINEMENT
R. W. Moir 27 Jan. 1978 23 p Presented at 2nd DMFE Hybrid Reactor Meeting, Wash., D. C., 2 Nov. 1977
(Contract W-7405-eng-48)
(UCRL-80667; Conf-771155-3) Avail: NTIS HC A02/MF A01

Technology requirements for mirror hybrid reactors are discussed. The required 120-keV neutral beams can use positive ions. The magnetic fields are 8 T or under and can use Nbti superconductors. The value of Q (where Q is the ratio of fusion power to injection power) should be in the range of 1 to 2 for economic reasons relating to the cost of recirculating power. The wall loading of 14-MeV neutrons should be in the range of 1 to 2 MW/m squared for economic reasons. Five-times higher

wall loading will likely be needed if fusion reactors are to be economical. The magnetic mirror experiments 2XIIB, TMX, and MFTF are described. ERA

N78-30951# Princeton Univ., N. J. Plasma Physics Lab.
BLISTER DIVERTOR FOR TOKAMAKS
S. L. Gralnick Jan. 1978 16 p refs
(Contract EY-76-C-02-3073)
(PPPL-1388) Avail: NTIS HC A02/MF A01

The results of model calculations that demonstrate the feasibility of producing the required blister region and a preliminary evaluation of the divertor collection efficiency are presented. ERA

N78-30952# Bechtel Corp., San Francisco, Calif.
LASER FUSION-FISSION REACTOR SYSTEMS STUDY: 4000 MW LASER FUSION HYBRID REACTOR
Jan. 1977 70 p
(Contract W-7405-eng-48)
(UCRL-13796) Avail: NTIS HC A04/MF A01

A hybrid reactor with a sodium-cooled depleted uranium fission blanket and liquid lithium tritium breeding fusion blankets is the central point in a laser fusion-fission reactor power plant. Driven by a selenium gas laser, the reactor produces a total of 4000 MWt. This energy is transferred by sodium and lithium coolant systems to steam generators. The thermal energy in the steam is then converted to electrical energy by a modified light water reactor (LWR) steam turbine generator system. A gross electrical output of 1520 MWe is attained. The net electrical output varies between 1195 and 1232 MWe depending upon the changing multiplication of energy in the reactor and the complementary consumption of power by the laser system. Topics covered include: (1) reactor design, (2) laser system, (3) power plant concept, (4) environment and safety, (5) economics, and (6) design options. ERA

N78-30953# Hanford Engineering Development Lab., Richland, Wash
HEDL MAGNETIC FUSION ENERGY PROGRAMS Progress Report, Jul. - Sep. 1977
D. G. Doran, comp. Jan. 1978 64 p refs
(Contract EY-76-C-14-2170)
(HEDL-TME-77-110) Avail: NTIS HC A04/MF A01

Progress is described in three HEDL programs supported by the U.S. Department of Energy's Division of Magnetic Fusion Energy. They are: (1) irradiation effects analysis, (2) mechanical performance of MFE materials, and (3) preparation and presentation of design data. Helium production cross sections for isotopes of Fe, Ni, and Cr, calculated with the HAUSER 4 code, are tabulated at 15 MeV. Agreement with measurements on Al and Cu was demonstrated. The energy dependence of the (n, alpha), (n, alpha n) and (n, n alpha) cross sections in the 13 to 20 MeV range are plotted for (56)Fe. A computer code was developed for calculating the energy deposition by 0.5 to 25 MeV protons incidents on a cylindrical metal specimen. New additions to the Nuclear Systems Materials Handbook include low cycle fatigue of Type 304 stainless steel; swelling correlation for 30% coldworked Type 316 stainless steel; friction, wear, and self-welding of Tribaloy 700; process guidelines on cleaning and cleanliness; physical properties of stainless steels; and fatigue-crack growth behavior of Inconel 600 and 718. ERA

N78-30954# Northwestern Univ., Evanston, Ill.
NUMERICAL SIMULATIONS OF PLASMAS WITH SMOOTHING IN PHASE SPACE AND FILTERING IN TIME Progress Report, 1 Oct. 1976 - 30 Sep. 1977
J. Denavit 1977 8 p refs
(Contract EY-76-S-02-2200)
(COO-2200-9) Avail: NTIS HC A02/MF A01

New numerical methods for particle and hybrid simulation of plasmas and their application to physical problems of current significance to magnetic fusion energy are considered. Research on the project was concerned with the following specific problems: (1) analysis and computer simulations of the dissipative trapped-electron instability in Tokamaks; (2) computer simulation of field-reversed ion ring stability; and (3) computer simulations of nonlinear electrostatic wave phenomena. ERA

N78-30955# Princeton Univ., N. J. Plasma Physics Lab.
DOPPLER MODEL FOR ADIABATIC TOROIDAL COMPRESSOR DRIFTWAVE FREQUENCY PROFILES
R. A. Koch and W. M. Tang Oct. 1977 12 p refs
(Contract EY-76-C-02-3073)
(PPPL-1381) Avail: NTIS HC A02/MF A01

Microwave and CO2 laser scattering experiments on ATC (adiabatic toroidal compressor) Tokamak have shown that there exists a spectrum of fluctuations with parallel bar f parallel bar = parallel bar omega/2pi parallel bar less than or equal to 1 MHz at wavelengths lambda approximately 0.28 cm and with parallel bar f parallel bar less than or equal to 400 kHz for lambda approximately 1 cm. However, a typical maximum frequency calculated for given experimental density and temperature profiles is f less than or equal to 150 kHz for the longer wavelengths and differs with the experimental results by roughly a factor of 2 or 3. At shorter wavelengths the calculated maximum f is less than or equal to 100 kHz, which differs quite substantially with the experimental result. This discrepancy is interpreted as evidence of vector E x vector B Doppler shift from a radial electric field. ERA

N78-30956# Oak Ridge National Lab., Tenn.
DRAFT PROGRAM PLAN FOR TNS: THE NEXT STEP AFTER THE TOKAMAK FUSION TEST REACTOR. PART 1: SUMMARY
M. Roberts Oct. 1977 80 p
(Contract W-7405-eng-26)
(ORNL/TM-5982) Avail: NTIS HC A05/MF A01

A draft program plan for TNS was prepared which consists of two basic parts-an R and D Needs Assessment and a Project Plan with schedules and necessary implementation steps. In this effort, questions concerning (1) the present basis for the TNS program, (2) the principal gaps in the supporting program, and (3) the necessary actions to be taken to implement the TNS program were examined. The study supported the thesis that the physics and technology bases do exist from which to start the TNS design as a central fusion program goal. Specific recommendations are made to emphasize those physics, technology, and engineering areas in which there are program gaps. In the project engineering study, basic schedule with close support from the R and D program is developed from which recommendations on administrative actions and areas for further elucidation are made. Presented in summary form are the findings of the study, the development of the principal theses, and the recommendation to ERDA-DMFE. ERA

N78-30957# Oak Ridge National Lab., Tenn.
PLASMA ENGINEERING CONSIDERATIONS FOR AN IGNITION TEST REACTOR: THE NEXT STEP (TNS) BEYOND TFTR
Y. K. M. Peng, J. D. Callen, F. B. Marcus, J. R. McNally, Jr., A. T. Mense, N. A. Uckan, J. A. Rome, S. E. Attenberger, J. A. Holmes, and D. J. Strickler 1977 6 p refs Presented at ANS Winter Meeting, San Francisco, Calif., 27 Nov. 1977
(Contract W-7405-eng-26)
(CONF-771109-76) Avail: NTIS HC A02/MF A01

Plasma engineering studies were done to establish credible ranges of physics parameters to be integrated into the TNS study program. The following are reviewed: high beta equilibrium, high density, basic assumptions, zero-dimensional scaling, one-dimensional effects, equilibrium evolution, injection scenario, MHD stability limits, equilibrium fields and flexibility. ERA

N78-30958# Brookhaven National Lab., Upton, N. Y.
GENERATION OF CURRENT AS A RESULT OF INTERACTION BETWEEN A BEAM OF ACCELERATED MULTICHARGE IONS AND PLASMA
A. V. Gurevich 1977 10 p refs Transl. into ENGLISH from Pisma Ah. Eksp. Teor. Fiz. (USSR), v. 25, no. 10, 1977 p 469-473 Sponsored by ERDA
(BNL-TR-655) Copyright. Avail: NTIS HC A02/MF A01

A half-space filled with the plasma x greater than 0 into which a compensated beam of Z ions of mass Mz is injected with a velocity v sub o in the x direction is examined. Since the concentration of electron and ions N in the plasma is much greater than the density of the Z ions (N) greater than N/sub z/), the slowing-down process of the Z ions plasma is independent

of the interaction between them, i.e., it has a linear character. Moreover, since only the fast multicharge ions whose velocity is of the order of the thermal velocity of the electrons are considered, one can disregard in the first approximation the motion of the main plasma ions. ERA

N78-30959# Oak Ridge National Lab., Tenn.
ECONOMIC EVALUATION OF TOKAMAK POWER PLANTS
R. L. Reid and D. Steiner 1977 23 p refs Presented at the IAEA Conf. and Workshop on Fusion Reactor Design, Madison, Wis., 12 Oct. 1977
(Contract W-7405-eng-26)
(CONF-771056-3) Avail: NTIS HC A02/MF A01

The impact of plasma operating characteristics, engineering options, and technology on the capital cost trends of Tokamak power plants is examined. Tokamak power systems are compared to other advanced energy systems and found to be economically competitive. A three-phase strategy for demonstrating commercial feasibility of fusion power, based on a common-site multiple-unit concept is presented. ERA

N78-30960# Oak Ridge National Lab., Tenn.
EFFECTS OF FUELING PROFILES ON PLASMA TRANSPORT
W. A. Houlberg, A. T. Mense, S. E. Attenberger, and S. L. Milora 1977 6 p refs Presented at the Workshop on Fusion Fueling, Princeton, N. J., Nov. 1977
(Contract W-7405-eng-26)
(CONF-771129-5) Avail: NTIS HC A02/MF A01

The effects of cold particle fueling profiles on particle and energy transport in an ignition sized Tokamak plasma are investigated in this study with a one-dimensional multifluid transport model. A density gradient driven trapped particle microinstability model for plasma transport is used to demonstrate potential effects of fueling profiles on ignition requirements. Important criteria for the development of improved transport models under the conditions of shallow particle fueling profiles are outlined. A discrete pellet fueling model indicates that large fluctuations in density and temperature may occur in the outer regions of the plasma with large, shallowly penetrating pellets, but fluctuations in the pressure profile are small. The hot central core of the plasma remains unaffected by the large fluctuations near the plasma edge. ERA

N78-30961# Princeton Univ., N. J. Plasma Physics Lab.
HIGHER-ORDER MULTIPOLES AND SPLINES IN PLASMA SIMULATIONS
H. Okuda and C. Z. Cheng Dec. 1977 29 p refs
(Contract EY-76-C-02-3073)
(PPL-1404) Avail: NTIS HC A03/MF A01

Reduction of spatial grid effects in plasma simulations was studied numerically using higher order multipole expansions and spline method in one dimension. It was found that, while keeping the higher order moments such as quadrupole and octopole moments substantially reduces the grid effects, quadratic and cubic splines in general have better stability properties for numerical plasma simulations when the Debye length is much smaller than the grid size. In particular, spline method may be useful in three dimensional simulations for plasma confinement where the grid size in the axial direction is much greater than the Debye length. ERA

N78-30962# Princeton Univ., N. J.
ENERGY PRINCIPLE IN A STRONG MAGNETIC FIELD AND THE KINK INSTABILITY OF A TOROIDAL PLASMA COLUMN
O. P. Pogutse and A. E. Yurchenko Oct. 1977 31 p refs Transl. into ENGLISH from Russian Report, Moscow, 1977 31 p
(Contract EY-76-C-02-3073)
(PPPL-Trans-122) Avail: NTIS HC A03/MF A01

A expression for the energy principle is derived, in which the kinetic and potential energy appear as functionals of a single function. This is possible because of the expansion of the exact expression in inverse powers of the strength of the toroidal magnetic field. This simplified energy principle is valid up to terms of second order in the curvature. An expression was found applicable to the investigation of the kink instability of a toroidal plasma column. The toroidal curvature causes a separation of the model branches and the appearance of a forbidden zone in the spectrum of stable Alfven oscillations. The appearance of this zone demonstrates that increasing plasma pressure worsens its stability. This effect is proportional to the curvature and the plasma pressure and apparently explains the bounds on plasma pressure obtained in recent numerical calculations for a Tokamak with high beta. ERA

N78-30963# Blalock (S. D., Jr.), Kingsport, Tenn.
OBSERVATION OF FAST IONS IN A LASER PLASMA
Yu. A. Zakharenkov, O. N. Krokhin, G. V. Sklizkov, and A. S. Shikanov [1978] 4 p refs Transl. into ENGLISH from Zh. Eksp. Teor. Fiz. (USSR), v. 25, no. 9, 1977 p 415-418 Sponsored by DoE Prepared for ORNL
(ORNL-TR-4536) Avail: NTIS HC A02/MF A01

A group of fast ions with energy equal to or less than 0.5 MeV was detected in experiments on heating spherical targets on the Kal mar powerful laser installation. The possible generation mechanisms are discussed. ERA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N78-30964 Texas Technological Univ., Lubbock.
MAGNETIC SUSCEPTIBILITY AND INFRARED SPECTRA OF CERIUM IN SrF2, CaF2, AND SrCl2 Ph.D. Thesis
Gary Lee Walker 1977 124 p
Avail: Univ. Microfilms Order No. 78-10857

Experimental work was devoted to relating the optical and magnetic properties of rare earth ions in host crystals to their crystal field energy splittings. In particular, conclusive results are given for several of the intermediate and heavy ions in the rare earth series. The magnetic susceptibility of trivalent cerium ions was measured by the Faraday method for three different isomorphic host crystals in order to obtain the fourth-order crystal field parameters. The temperature range used was 1.5-300K. These results were combined with infrared absorption spectra taken at 77K and 300K and with ultraviolet work to obtain the sixth order parameters. Dissert. Abstr.

N78-30965 California Univ., Berkeley.
MEAN FIELD THEORIES OF THE ISOTROPIC-NEMATIC PHASE TRANSITION IN LIQUID CRYSTALS Ph.D. Thesis
Barbara Ann Baron 1977 149 p
Avail: Univ. Microfilms Order No. 7812481

New theories of the isotropic-nematic phase transition are proposed. The first is a cluster expansion approach. The treatment is a modified mean field theory analogous to the cluster expansion description of the spontaneous magnetization transition in ferro magnetic systems. A generalized van der Waals theory is developed. The a priori derivation allows the repulsions and attractions to couple. For the special case where the repulsions are taken to be hard spheres and the attractions to be the dispersional interactions, the model leads to an equation for the orientational distribution function identical in form to that of Maier-Saupe theory. For non-spherical repulsions, the repulsions are found to couple to the attractions. The coupling between the anisotropic repulsions and the isotropic attraction is found to dominate the transition. Dissert. Abstr.

N78-30966 California Univ., Berkeley.
ACOUSTIC ABSORPTION BY THE ELECTRON-HOLE LIQUID IN GERMANIUM Ph.D. Thesis
Anthony David Anders Hansen 1977 227 p
Avail: Univ. Microfilms Order No. 78-12588

The absorption of ultrasonic acoustic waves by the electron-hole liquid created in germanium at liquid helium temperatures by intense optical excitation was investigated. Topics cover the interaction of the mobile liquid with a travelling acoustic wave force field, the attenuation of the wave due to energy-dissipative processes coupling the liquid to the crystal lattice,

and the effect of a moderately strong magnetic field on the dynamic behaviour of the system. The experimental apparatus is described and problems encountered in obtaining good ultrasonic pulse echoes from which reliable attenuation measurements could be made are discussed. Dissert. Abstr.

N78-30967 Maryland Univ., College Park.
ANALYSIS OF DE-HAAS-VAN-ALPHEN DATA FROM NICKEL AND TUNGSTEN USING LINEARLY RECURSIVE FITTING Ph.D. Thesis
Peter Aaron Heimann 1977 277 p
Avail: Univ. Microfilms Order No. 7814018

The de Haas-van-Alphen (dHvA) effect was used to study the effects of carrier scattering in single-crystal ferromagnetic nickel. The relevant aspects of the dHvA effect are described, including its use in determining the cyclotron effective mass, scattering temperature, spin-splitting g-factor, and other parameters of physical interest. The experimental apparatus, including a home-built interface to a PDP-9 computer and appropriate software, is also described. The results of preliminary tests as applied to non-ferromagnetic metals (ReO3 and tungsten) are described, followed by the results of measurements on ferromagnetic nickel, which show that, for certain electrons (the hole pockets at X), the carrier scattering temperature increases with decreasing magnetic fields. Several possible explanations are presented for this field dependence. Dissert. Abstr.

N78-30968 Iowa State Univ. of Science and Technology, Ames.
DETERMINATION OF PHASE BOUNDARIES AND DIFFUSION PARAMETERS IN TANTALUM HYDRIDES BY PULSED NMR Ph.D. Thesis
Phillip Allen Hornung 1978 109 p
Avail: Univ. Microfilms Order No. 7813231

A pulsed nuclear magnetic resonance spectrometer was constructed. A simple non-saturating receiver amplified the detected signal with less than one microsecond recovery time following an rf pulse. Circuitry was employed to automatically sample the recovery of the magnetization at regularly incremented intervals, thereby eliminating systematic errors. Finally, data reduction was accomplished with a digital computer interfaced into the signal averager which accumulated the free induction decay amplitudes. Proton spin-lattice relaxation times T sub 1 were measured over a wide range of temperature and compositions in the tantalum-hydrogen system at a frequency of 40,000 MHz. In the high temperature solid solution alpha phase, the activation energy for hydrogen diffusion was found to be 0.140 + or - 0.002eV/atom, and the value of the jump rate was found to be essentially constant throughout the range of compositions studied. Dissert. Abstr.

N78-30969 California Univ., Berkeley.
LOW FREQUENCY NOISE IN METAL FILMS AT THE SUPERCONDUCTING TRANSITION. 2: RESISTANCE OF SUPERCONDUCTOR-NORMAL METAL-SUPERCONDUCTOR JUNCTIONS Ph.D. Thesis
Thomas Yih Hsiang 1977 175 p
Avail: Univ. Microfilms Order No. 7812612

Measurements are reported of the noise power spectra S sub v (f) of tin and lead films at the superconducting transition in the frequency range of 0.1 Hz to 5k Hz. Two types of samples were made. Type A were evaporated directly onto glass substrate, while Type B were evaporated onto glass or sapphire substrate with a 50 angstrum aluminum underlay. The results were consistent with a thermal diffusion model which attributes the noise to the intrinsic temperature fluctuation in the metal film driven with a random energy flux source. A theoretical and experimental investigation was made on the resistance of superconductor-normal metal-superconductor sandwiches near T sub c. The increase in SNS resistance is attributed to the penetration of normal electric current in the superconductor. It is proven from first principle that electric field can exist inside the superconductor when quasiparticles are not equally populated on the two branches of the excitation spectrum, and such is the case in a current biased SNS junction. Dissert. Abstr.

N78-30970 California Univ., Berkeley.
TOPICS IN DUAL MODELS AND EXTENDED SOLUTIONS Ph.D. Thesis
Robert Stephen Roth 1977 42 p Sponsored by DOE
Avail: Univ. Microfilms Order No. 7812755

Two main topics are explored. The first deals with the infinities arising from the one loop planar string diagram of the standard dual model. It is shown that for the number of dimensions d = 25 or 26, these infinities lead to a renormalization of the slope of the Regge trajectories, in addition to a renormalization of the coupling constant. The second topic deals with the propagator for a confined particle (monopole) in a field theory. When summed to all orders, this propagator is altogether free of singularities in the finite momentum plane, and an attempt is made to illustrate this. The BetheSalpeter equation is examined and shows that ladder diagrams are not sufficient to obtain this result. However, in a nonrelativistic approximation confinement is obtained and all poles disappear. Dissert. Abstr.

N78-30971# Sperry Research Center, Sudbury, Mass.
MAGNETIC LPE CRYSTALLINE FILMS FOR SMALL-BUBBLE-DIAMETER CYLINDRICAL-DOMAIN MEMORY APPLICATIONS Final Report, 15 May 1976 - 30 Sep. 1977
M. Kestigian, W. R. Bekebrede, and A. B. Smith Wright-Patterson AFB, Ohio AFAL Oct. 1977 46 p refs
(Contract F44620-76-C-0121)
(AD-A054272; SCRC-CR-78-9; AFAL-TR-77-257) Avail: NTIS HC A03/MF A01 CSCL 20/12

Results of the magnetic property experiments were used to select improved rare-earth iron garnet compositions and film deposition parameters for 2 micrometers or less bubble-diameter magnetic memory applications. Representative results of over 600 LPE film preparations and delivered samples are given in tabular form. Of the materials investigated, samarium thulium-, yttrium samarium thulium-, yttrium samarium lutetium-, and yttrium europium thulium gallium iron garnet were found to possess static bubble properties suitable for small bubble diameter applications. Yttrium samarium lutetium calcium germanium iron garnet small-bubble-diameter films were prepared and evaluated for comparison of their magnetic properties. In addition to the static magnetic property experiments, dynamic measurements were performed on (LaEuTm)3(FeGa)5O12, (SmTm)3(FeGa)5O12, (YSmLuCa)3(FeGe)5O12 and (YSmTm)3(FeGa)5O12. Mobilities of 233, 140, 1000 and 660 cm/sec/Oe, respectively, were determined for representative samples. It was concluded that these materials will be useful for small-bubble-diameter cylindrical-domain memory-device applications. Author (GRA)

N78-30972# Wayne State Univ., Detroit, Mich. Dept. of Electrical Engineering.
TRANSFERRED ELECTRON EFFECTS IN n-GaAs AND n-InP UNDER HYDROSTATIC PRESSURE
Wolodymyr Czubatyj, M. S. Shur, and M. P. Shaw 4 Apr. 1978 9 p refs
(Contract N00014-75-C-0392)
(AD-A054318) Avail: NTIS HC A02/MF A01 CSCL 20/8

To obtain useful results for fundamental band structure parameters using transferred electron effects, the investigator must begin with high purity, high mobility material, relatively free from ionized impurities. This can usually be achieved by epitaxial growth. The epitaxial samples should be grown on a semi-insulating substrate and shaped into 'H' or turret patterns to minimize effects due to the metallic contacts. Turret shaped samples are best since in one polarity a boundary condition producing either transit time oscillations or current saturation due to a high cathode field will yield values of the saturated drift velocity. In the opposite polarity, the absence of a domain mode and a sufficiently high value of the peak velocity, along with current saturation or switching, or circuit controlled oscillations, can then provide confidence that low boundary field conditions have been achieved. GRA

N78-30973# Institute for Defense Analyses, Arlington, Va.
AN OVERVIEW AND ASSESSMENT OF SELECTED DOD HIGH PRESSURE TECHNOLOGY R AND D PROGRAMS Final Report, May - Nov. 1977
John E. Hove Jan. 1978 63 p refs
(Contract DAHC15-73-C-0020)
(AD-A054018; AD-E500027; P-1302) Avail: NTIS

HC A04/MF A01 CSCL 13/8

The Deputy Director for Research and Advanced Technology, ODDR/E, requested IDA to conduct a set of selected studies of the DoD Technology Base Programs in materials and structures. This paper deals with one aspect of these studies, namely the use of high pressures to synthesize or process new or improved materials. The objective of this task is to provide an assessment of the potential application benefits of such R/D and of its chances of success in producing practical and useful results. Over the past decade, the U.S.S.R. has made major investments in high-pressure technology, perhaps an order of magnitude greater than comparable investments made by the U.S. One of the most publicized goals of the Soviet work is the synthesis of a metallic state of hydrogen, which, if feasible, could have very important military implications. The assessment of the present study, however, concludes that this goal is still too scientifically tenuous to justify any major increase in U.S. R/D effort. Nonetheless, the potential national and military benefits are great and a more focused joint research program is recommended between the DoD, NSF, DoE, and NASA. Another closer-term benefit of high-pressure technology could be its use to process and form brittle materials. GRA

N78-30974# Army Electronics Research and Development Command, Fort Monmouth, N. J. Electronics Technology/Devices Lab.

TIN OXIDE ROOM TEMPERATURE EMITTER STUDY

Horst H. Kedesdy and Richard Sartore Jan. 1978 51 p refs

(AD-A054449; DELET-TR-78-4) Avail: NTIS HC A04/MF A01 CSCL 11/2

The mechanisms of activation and electron emission of tin dioxide film room temperature emitters for cold-cathode application have been investigated. The structure, composition and electrical resistivity of vapor deposited films of various thicknesses and antimony doping concentrations have been determined. Activation and electron emission characteristics, as well as seasoning effects of room temperature emitter elements fabricated from such films have been studied. Data and information obtained have been utilized to extend previous analysis of the mechanisms involved in the activation and emission processes. Optimization of material parameters and emitter geometry for efficient and stable room temperature emission have been discussed. A new activation method using a laser beam in conjunction with an electrical current to increase the emitter area has been developed. Author (GRA)

N78-30975# Princeton Univ., N. J. Dept. of Electrical Engineering.

STUDY OF ELECTRONIC TRANSPORT AND BREAKDOWN IN THIN INSULATING FILMS Semiannual Report

Walter C. Johnson 1 Dec. 1977 83 p refs

(Contract DAAG53-76-C-0059; DARPA Order 2182)

(AD-A054984; NVL-0059-007; SATR-4) Avail: NTIS HC A05/MF A01 CSCL 20/3

Recent progress is reported in an ongoing program of studies of high-field effects in thin insulating films on semiconducting substrates. The investigations reported here include the high-field generation of electron traps in SiO2, the high field generation of interface states in the Si-SiO2 system, the influence of holes at the interface and the effects of temperature on interface-state generation in the Si-SiO2 system, and studies of high-field effects in the Si-Al2O3 system. Author (GRA)

N78-30976# Harry Diamond Labs., Adelphi, Md.

HIGHER ORDER TERMS IN THE MAGNETIC INTERACTION OF AN ION IN A SOLID

Richard P. Leavitt and Clyde A. Morrison May 1978 32 p refs

(Da Proj. 1W1-61102-AH-44)

(AD-A054747; HDL-TR-1852) Avail: NTIS HC A03/MF A01 CSCL 20/3

The interaction Hamiltonian of an electron on an ion in the presence of a magnetic dipole is derived. This interaction is then cast into unit spherical tensor form for the N electron configuration (nl) superscript N. The lowest term in the interaction is shown to be the conventional term used in an effective internal field approximation. The remaining terms of the interaction can cause term dependent splitting of a magnetic impurity. Author (GRA)

N78-30977# Connecticut Univ., Storrs.

ELECTRON-DISLOCATION INTERACTION AT LOW TEMPERATURES Progress Report

1978 7 p refs

(Contract EY-76-S-02-2305)

(COO-2305-5) Avail: NTIS HC A02/MF A01

The interaction of mobile dislocations with electrons in copper and copper alloys was investigated. It is shown that dislocation motion in copper, at low temperature, can be treated as an analog of an underdamped oscillator that the viscous drag on mobile dislocations in type 2 superconductors can be treated as an acoustic attenuation of an elastic wave. ERA

N78-30978# Sandia Labs., Albuquerque, N. Mex.

PHOTOFERROELECTRIC EFFECTS IN PLZT CERAMICS

C. E. Land and P. S. Peercy 1977 16 p refs Presented at the 4th Intern. Meeting on Ferroelectricity, Leningrad, 18 Sep. 1977

(Contract EY-76-C-04-0789; AT(29-1)-789)

(SAND-77-0685C; Conf-770946-1) Avail: NTIS HC A02/MF A01

A photoferroelectric effect described as photoassisted domain switching (PDS) is used to store high resolution, high contrast, nonvolatile optical information, including gray scale images in PLZT ceramics. Image storage is achieved by switching the ferro-electric remanent polarization while exposing the image on one of the indium tin oxide electroded surfaces of a PLZT plate, using near-UV light at the PLZT band gap energy (3.35 eV). PDS eliminates the photoconductive films required in previous PLZT image storage devices. Some characteristics of the PDS effect which apply to image storage and selective erasure are described. Image processing to achieve contrast enhancement is also discussed. ERA

N78-30979# Stanford Linear Accelerator Center, Calif.

RECENT ADVANCES IN BOUND STATE QUANTUM ELECTRODYNAMICS

Stanley J. Brodsky and G. Peter Lepage Jun. 1977 24 p refs Presented at the 4th Intern Colloq. on Advan. Computing Methods in Theoret. Phys., Saint Maximin, France, 21-23 Mar. 1977

(Contract EY-76-S-03-0326)

(SLAC-Pub-1966; Conf-770392-1) Avail: NTIS HC A02/MF A01

Reviewed are four areas of computational quantum electrodynamics: a new relativistic two body formalism equal in rigor to the Bethe-Salpeter formalism but with strong calculational advantages is discussed; computation of the decay rate of bound systems (positonium in particular); limits on possible composite structure of leptons and a new multidimensional integration program ('VEGAS') suitable for higher order calculations. ERA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N78-30980 Maryland Univ., College Park.

ON THE APPLICATION OF THE N-QUANTUM APPROXIMATION METHOD TO BOUND STATE PROBLEMS Ph.D. Thesis

Amitava Raychaudhuri 1977 109 p

Avail: Univ. Microfilms Order No. 7812890

The N-quantum approximation (NQA) method is examined in the light of its application to bound state problems. From the equations of motion for the Heisenberg fields and the NQA expansion, an equation satisfied by the wavefunction is derived. The bound state problem of two identical scalars by scalar

exchange is analyzed using the NQA. An integral equation satisfied by the wavefunction is derived. In the nonrelativistic limit, the equation is shown to reduce to the Schrodinger equation. The NQA method is also applied to the bound state of two spin 1/2 particles with electromagnetic interaction. The integral equation for the wavefunction is shown to agree with the corresponding Bethe Salpeter equation in the nonrelativistic limit. Dissert. Abstr.

N78-30981# Dow Chemical Co., Midland, Mich. Thermal Research Lab.

CALCULATION OF THERMODYNAMIC PROPERTIES OF IDEAL GASES AT HIGH TEMPERATURES: MONATOMIC GASES Interim Report

J. R. Downey, Jr. 9 Mar. 1978 35 p refs
(Contract F44620-75-C-0048)
(AD-A054854; AFOSR-78-0960TR) Avail: NTIS HC A02/MF A01 CSCL 20/13

The dual purpose of this report is to address the problems involved in extending the JANAF Thermochemical Tables for monatomic gases to higher temperatures (e.g. T = 6000 K), and the formulation of more definitive procedures for producing the tables in their present format (T - or + 6000 K). Since there is a total lack of experimental thermochemical data for high temperature gases, statistical mechanics must be used to calculate the thermodynamic properties. Thus, some discussion of statistical mechanics is necessary and this is included in a non-rigorous manner. The problem of finding a suitable cutoff procedure for the electronic partition function constitutes the body of this report. In the final section a recommended method of extending the calculations to higher temperature is advanced, and a brief discussion of the remaining problems in implementing this method is given. An annotated bibliography of relevant literature is included. A method of predicting the theoretical statistical weight for the electronic energy levels of the first 86 elements is presented in an appendix. Author (GRA)

N78-30982# Oak Ridge Gaseous Diffusion Plant, Tenn.

DIRECT SOLUTION TECHNIQUE FOR SOLVING STEADY-STATE PROBLEMS USING THE HEATING5 HEAT TRANSFER CODE

B. R. Becker Oct. 1977 45 p refs
(Contract W-7405-eng-26)
(K/CSD/TM-15) Avail: NTIS HC A03/MF A01

A direct solution technique for one and two dimensional steady state problems was added to HEATING5. This technique uses a convergence criterion based upon the nodal heat residual, rather than the maximum relative change in temperature, which is the convergence criterion used by HEATING5 in the successive overrelaxation technique for steady state problems. The direct solution technique consists of an interface subroutine, which uses the nodal configuration and effective conductances between nodes (as generated by HEATING5) to build a banded system of equations. A second routine then solves the system. ERA

N78-30983# McElroy (Ralph) Co., Austin, Tex.

ABSORPTION OF THERMAL RADIATION BY LAYERS OF CONDENSED GASES

S. F. Grishin, E. Ya. Grishina, V. A. Kovalenko, R.V. Minin, and V. Ya. Chernyshenko 1977 13 p refs Transl. into ENGLISH from Zh. Tekh. Fiz.(USSR), v. 47, 1977 p 1050-1054 Prepared for Los Alamos Sci. Lab., N. Mex.
(LA-TR-77-59) Avail: NTIS HC A02/MF A01

The measurements of infrared radiation absorption by layers of condensed gases showed that layers of N2 and Ar are essentially transparent in the region of long wavelengths between 5 and 40 microns and that layers of H2 and especially H2O strongly absorb infrared radiation in that region. The difference can be explained by the distribution of molecular absorption bands, conditioned by the intermolecular interactions in the condensed state. From the experimental results obtained, an evaluation of the coefficients of absorption was carried out for thin layers of solid H2O, N2 and H2. ERA

N78-30984# Montpellier Univ. (France). Dept. de Physique Mathematique.

THE PERTURBATION THEORY OF THE ANHARMONIC OSCILLATOR AT LARGE ORDER

G. Auberson, G. Mennessier (Centre d'Etudes Nucl., Gif-sur-Yvette, France), and G. Mahoux Feb. 1978 28 p refs
(PM/78/2) Avail: NTIS HC A03/MF A01

Using the Lipatov approach, the large n behavior of the nth coefficient in the perturbation expansion for the ground state energy E(g) of the anharmonic oscillator was studied. The calculations do not rely on the analyticity properties of E(g) in the coupling constant g. The 1/n correction to the leading term was computed and led to recover the result of Bender and Wu. A general renormalization procedure is conjectured, which has been checked up to the order 1/n to the cube. Author (ESA)

N78-30985# Loughborough Univ. of Technology (England). Dept. of Mathematics.

ON NON-NULL EINSTEIN-MAXWELL FIELDS

J. B. Griffiths Jun. 1977 7 p refs
(MATHS-Res-111) Avail: NTIS HC A02/MF A01

A non-null electromagnetic field can be regarded as a sum of two null fields defining two null congruences. The case of parallel propagation along these congruences was considered. A twist-free solution was given. It was found that expansion-free solutions do not exist. Author (ESA)

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N78-30986# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

MANUAL OF EDUCATIONAL RESEARCH: PROCEDURES FOR THE DESIGN, CONDUCT AND REPORTING OF RESEARCH IN EDUCATION M.S. Thesis

Maria DoCarmo Salomao Salutti Feb. 1978 144 p refs In PORTUGUESE; ENGLISH summary
(INPE-1195-TPT/081) Avail: NTIS HC A07/MF A01

The manual of educational research was elaborated with the purpose of introducing such procedures in an accessible form and to provide a guide for those interested in carrying out educational research. The preliminary considerations are about the context in which the manual is imbedded, including the role of educational research in the process of educational change and improvement, the importance given to it by the Brasilian Government and, finally, a description of the Brasilian educational research at present. The above is followed by a review on research procedures. A model of procedures for the design, conduct, and reporting of educational research is then introduced and discussed. The components of the model, the procedures represented by it, are then individually described, including their operationalization, exemplification, justification for their inclusion in the model and suggestions about their implementation. B.B.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N78-30987# School of Aerospace Medicine, Brooks AFB, Tex.

COMPUTER SIMULATION OF AIRCREW MANAGEMENT POLICIES Final Report, 1 Jan. 1976 - 1 Nov. 1977

Paul Garcia, Paul A. Lozano, Harry M. Hughes, and Bryce O. Hartman Apr. 1978 13 p
(AD-A054948; SAM-TR-78-15) Avail: NTIS HC A02/MF A01 CSCL 05/9

This report describes a computer program which enables studies on aircrew management policies to be performed. It describes the various inputs, the run time procedures, and the various outputs that were employed in a transport air lift study utilizing the program. The comprehensive but flexible complex of subroutines is easily adapted to inventive, even novel, employment of aircrews. The outputs can then be analyzed for the performance measures of the system. Author (GRA)

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N78-30988 California Univ., Los Angeles.
ADAPTIVE ESTIMATION OF INFORMATION VALUES IN REMOTE SYSTEMS Ph.D. Thesis
Randall Steeb 1978 185 p
Avail: Univ. Microfilms Order No. 78-11385

Communication between a remote system and a supervisory human often engender difficult problems. The object of this dissertation, is to place the responsibility with the remote element. A decision model can be used to weigh and aggregate the various consequence dimensions to arrive at evaluations of each communication choice. The model is based on Bayesian probability calculation, multi-attribute utility aggregation and nonparametric pattern recognition. In combination, these techniques result in a means of evaluating and autonomously managing communications. Both simulation tests and studies using human operators were performed with the adaptive estimation program. The model was found to be useful for identifying differing decision strategies.
Dissert. Abstr.

N78-30989# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
AUTOMATIC RETRIEVAL SYSTEM OF BIBLIOGRAPHIC MATERIAL: AN APPROACH TO THE APPLICATION OF CATALOGING REGULATIONS [SISTEMA DE ARMAZENAMENTO E RECUPERACAO DE MATERIAL BIBLIOGRAFICO: UMA ABORDAGEM SOBRE AS REGRAS CATALOGRAFICAS APLICADAS]
Celina C. Govedice, Hulda O. DeCarvalho, Janis A. Baldovinotti, Keila M. Monteiro, Newton M. Vasconcellos, Regina C. Pisanelli, Sonia M. P. Spilak, and Vilma L. Siqueira Mar. 1977 35 p refs In PORTUGUESE; ENGLISH summary Presented at 9o. Congr. Brasileiro e V. Jornada Sul-Riograndense de Biblioteconomia e Documentacao. Porto Alegre, Brazil, 3-8 Jul. 1977
(INPE-998-PE/054) Avail: NTIS HC A03/MF A01

The automatic system of bibliographic data processing as installed at INPE is presented. It shows the systematic of filling out the data forms for the entry in the computer system; the non-usual cataloging rules adopted; the control reports in the form of correction print-outs; subproducts, with the options offered by the system and the results in the form of index cards, obtained as final product.
G.Y.

N78-30990# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
A RETRIEVAL SYSTEM FOR METEOROLOGICAL DATA M.S. Thesis [UM SISTEMA DE RECUPERACAO DE DAPOS METEOROLOGICOS]
Arnildo Ananias Deoliveira and Paulo Seiji Nakaya Mar. 1977 150 p refs In PORTUGUESE; ENGLISH summary
(INPE-1002-TPT/048) Avail: NTIS HC A07/MF A01

An information retrieval system designed for meteorological data is presented. Although the system was developed having the retrieval of surface and upper-air data as its goal, it can be extended to other types of data, thus generalizing its utilization. The method presented is based on a retrieval language, through which the user codes the data to be retrieved. The user is able to choose periods of time, specific hours, variables, and other parameters related to the retrieved data.
J.M.S.

N78-30991# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
INFORMATION SYSTEM IN THE PLANNING PROCESS: DISCUSSION OF THE CARGO TRANSPORTATION SITUATION IN THE RIO SAO PAULO AREA M.S. Thesis [O PAPEL DE SISTEMA DE INFORMACOES NO PROCESSO DE PLANEJAMENTO: DISCUSSAO UTILIZANDO A SITUACAO DO TRANSPORTE DE CARGAS NO EIXO RIO-SAO PAULO]
Antonio Augusto Rocha Filho Mar. 1977 254 p refs In PORTUGUESE; ENGLISH summary
(INPE-1001-TPT/047) Avail: NTIS HC A12/MF A01

An example of an information system, to be used within a planning process, is presented. The chosen area is the interurban load transportation. Two modes of transportation are approached, the highway and the the railway. The information system consists of two models: the first one, based on the gravity model, estimates the flow of load vehicles on several stretches of a highway; the second one is based on simulation techniques to represent the process of train circulation on a railroad composed of single and double track sections. An application was made, utilizing Rio Sao Paulo axis as a study area.
B.B.

N78-30992*# Informatics Information Systems Co., Linthicum Heights, Md.
NASA AUTOMATIC SUBJECT ANALYSIS TECHNIQUE FOR EXTRACTING RETRIEVABLE MULTI-TERMS (NASA TERM) SYSTEM
Jack Kirschbaum and Robert E. Williamson 1978 27 p refs Sponsored by NASA
(NASA-CR-157398) Avail: NTIS HC A03/MF A01 CSCL 05B

Current methods for information processing and retrieval used at the NASA Scientific and Technical Information Facility are reviewed. A more cost effective computer aided indexing system is proposed which automatically generates print terms (phrases) from the natural text. Satisfactory print terms can be generated in a primarily automatic manner to produce a thesaurus (NASA TERMS) which extends all the mappings presently applied by indexers, specifies the worth of each posting term in the thesaurus, and indicates the areas of use of the thesaurus entry phrase. These print terms enable the computer to determine which of several terms in a hierarchy is desirable and to differentiate ambiguous terms. Steps in the NASA TERMS algorithm are discussed and the processing of surrogate entry phrases is demonstrated using four previously manually indexed STAR abstracts for comparison. The simulation shows phrase isolation, text phrase reduction, NASA terms selection, and RECON display.
A.R.H.

N78-30993# Oak Ridge National Lab., Tenn.
SYSTEM FOR HISTOGRAM ENTRY, RETRIEVAL, AND PLOTTING
M. Kellogg, Jeffrey M. Gallup (Lawrence Berkeley Lab., Univ. of Calif., Berkeley), Sally Shlaer (Lawrence Berkeley Lab., Univ. of Calif., Berkeley), and Nancy Spencer Oct. 1977 32 p
(Contract W-7405-eng-36)
(LA-6920-M) Avail: NTIS HC A03/MF A01

This manual describes the systems for producing histograms and dot plots that were designed for use in connection with the Q general-purpose data-acquisition system. These systems allow for the creation of histograms; the entry, retrieval, and plotting of data in the form of histograms; and the dynamic display of scatter plots as data are acquired. Although the systems are designed for use with Q, they can also be used as a part of other applications.
ERA

N78-30994# National Commission on New Technological Uses of Copyrighted Works, Washington, D. C.
TRANSCRIPT OF NATIONAL COMMISSION ON NEW TECHNOLOGICAL USES OF COPYRIGHTED WORKS MEETING NO. 21
Apr. 1978 201 p Meeting held at Washington, D.C., 20-21 Apr. 1978
(PB-281710/4) Avail: NTIS HC A10/MF A01 CSCL 05B

On the first day of the meeting, testimony on the draft of the photocopy subcommittee was presented. On the second day of the meeting the reports of the new works and software subcommittees were discussed. The majority of the commissioners voted to accept the report of the software subcommittee.
GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N78-30995 Pittsburgh Univ., Pa.
INVESTIGATION OF COMPETITION USING A DUAL MODE TRANSPORTATION SYSTEM MODEL Ph.D. Thesis
Koustubh Damodar Oka 1977 276 p
Avail: Univ. Microfilms Order No. 7809967

A model of a dual mode transportation system was improved and substantially extended to incorporate a demand generation portion which allowed competition between the two modes to be studied dynamically. Competition provides the policy planner a medium to test various policies out, given a validated behavioral demand model. A major thrust of this dissertation is to implement competition by proposing such a demand model and to exercise this competition model.
Dissert. Abstr.

N78-30996# Center for Naval Analyses, Arlington, Va.
LOTKA'S FREQUENCY DISTRIBUTION OF SCIENTIFIC PRODUCTIVITY
Russell C. Coile Feb. 1978 23 p refs Submitted for publication Prepared in cooperation with City Univ., London
(AD-A054425; CNA-PP-216) Avail: NTIS HC A02/MF A01 CSCL 05/2

In 1926, Alfred Lotka examined the frequency distribution of scientific productivity of chemists and physicists. After analyzing the number of publications of chemists listed in Chemical Abstracts 1907-1916 and the contributions of physicists listed in Auerbach's Geschichtstafeln der Physik, he observed that the number of persons making n contributions is about 1/n sq of those making one and the proportion of all contributors that make a single contribution is about 60%. Recently, investigators studying the applicability of 'Lotka's Law' to the humanities and to map librarianship may have misinterpreted Lotka's law and have concluded erroneously that the law applies to these fields. Corrected calculations indicate that Lotka's law does not apply.
Author (GRA)

N78-30997# Center for Naval Analyses, Arlington, Va.
BIBLIOMETRIC STUDY OF SCIENTIFIC PRODUCTIVITY
Russell C. Coile Mar. 1978 24 p refs
(AD-A054442; CNA-PP-217) Avail: NTIS HC A02/MF A01 CSCL 05/2

In 1926, Alfred J. Lotka examined the scientific publishing productivity of chemists. His bibliometric study of the number of chemists listed in Chemical Abstracts who had published one, two, three, etc. papers in a ten-year period was the first of many such studies. Lotka proposed an 'inverse square law' of scientific productivity in which the frequency of authors publishing x papers varied inversely as the square of x. Bibliometric research is underway to explore the applicability of other frequency distributions including Fisher's logarithmic series, Yule's Beta function and the Weibull distribution.
Author (GRA)

N78-30998# General Electric Co., Schenectady, N. Y.
NEAR-TERM ELECTRIC VEHICLE PROGRAM, PHASE 1 Final Report
Aug. 1977 161 p refs
(Contract EY-76-C-03-1294)
(SAN/1294-1) Avail: NTIS HC A08/MF A01

The rationale used in designing a four-passenger electric car for use in an urban environment is presented. The approach taken was to design an electric car utilizing current technology. On the basis of tradeoff analyses, upgrading improvements were identified which would permit the electric car to more nearly meet all of the ERDA near-term goals. A summary is given of the electric car design, including the chassis, drive train, major components, and the control. The phase 1 electric car design will meet many of the ERDA near-term goals. Upgrading development programs are identified.
ERA

N78-30999# California Univ., Livermore. Lawrence Livermore Lab.
ENERGY STORAGE SYSTEMS FOR AUTOMOBILE PROPULSION. VOLUME 1: OVERVIEW AND FINDINGS
E. Behrin, J. Bolger, C. L. Hudson, L. G. OConnell, B. Rubin, M. W. Schwartz, C. H. Waide, and W. J. Walsh 15 Dec. 1977 56 p refs
(Contract W-7405-eng-48)
(UCRL-52303-Vol-1) Avail: NTIS HC A04/MF A01

A technical analysis of energy storage devices and energy storage power systems for automobiles was performed. Study panels examined electrochemical, mechanical, and chemical/thermal storage devices and selected the most promising ones. The panels then identified the research and development tasks necessary to successful development, determined the relative likelihood of overcoming technical barriers, and assessed the probable performance characteristics of future production devices. The key characteristics sought for each projected device were specific energy and specific peak power. For batteries, the relationship between specific power and specific energy was also determined. Since projected characteristics of future storage devices are uncertain, decision analysis techniques were used to project values both as a function of time and as a function of confidence level. Costs of the storage devices were also forecast. From a large number of candidate storage devices, the study panels selected seven batteries, three mechanical devices, three hydrogen storage devices and one thermal energy storage device for detailed evaluation.
ERA

N78-31000# National Technical Information Service, Springfield, Va.
SEWAGE SLUDGE DISPOSAL, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Final Report, 1975 - May 1978
Mona F. Smith Jun. 1978 205 p Supersedes NTIS/PS-77/0410; NTIS/PS-76/0236; NTIS/PS-75/252
(NTIS/PS-78/0576/5; NTIS/PS-77/0410; NTIS/PS-76/0236; NTIS/PS-75/252) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

Citations of Federally-funded research on sludge disinfection, irradiation, digestion, dewatering, decontamination for land disposal, recycling, incineration, and ocean disposal are presented. The effect of sewage sludge disposal on water pollution, ecosystems, and the environment is also covered. Studies on regulations, legislation, costs, and planning are included. (This updated bibliography contains 200 abstracts, of which are new entries to the previous edition.)
GRA

N78-31001# National Technical Information Service, Springfield, Va.
SEWAGE SLUDGE DISPOSAL, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Final Report, Feb. 1976 - May 1978

Mona F. Smith Jun. 1978 225 p Supersedes NTIS/PS-77/0412; NTIS/PS-76/0237
(NTIS/PS-78/0577/3; NTIS/PS-77/0812; NTIS/PS-76/0237) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

Worldwide studies on sludge recycling, land application, incineration, biological degradation, and ocean dumping are cited. Sludge dewatering, drying, freezing detoxification, piping, and fermentation are among topics included. Chemical analysis, water pollution impacts, soil fertilization, and crop monitoring are also covered. (This updated bibliography contains 218 abstracts, 56 of which are new entries to the previous edition.) GRA

N78-31002# Village of Pewaukee, Wisc.
EVALUATION OF THE RBC PROCESS FOR MUNICIPAL WASTEWATER TREATMENT
David L. Kluge, Raymond J. Kipp (Marquette Univ., Milwaukee, Wis.), and Clifford J. Crandall (Marquette Univ., Milwaukee, Wis.) Mar. 1978 106 p
(Grant EPA-S-802905)
(PB-280496; EPA-600/2-78-028) Avail: NTIS HC A06/MF A01 CSCL 13B

The rotating biological contactor (RBC) process was evaluated for municipal waste water treatment in a two phase at study conducted at the 1779 cu m/day (0.47 mgd) Pewaukee, Wisconsin waste water treatment plant. The Phase 1 study demonstrated and evaluated the effectiveness and efficiency of the RBC process and compared its performance with a parallel 1136 cu m/day (0.30 mgd) trickling filter. The Phase 2 study demonstrated and evaluated phosphorus removal and treatment upgrading by mineral addition of different cation species to the RBC process at two different points upstream and downstream from the RBC units. Results indicated that: (1) better nitrification was achieved by the trickling filter; (2) mineral addition improved RBC phosphorus removal but resulted in a deterioration of effluent BOD and SS values. G.Y.

N78-31003# National Technical Information Service, Springfield, Va.
URBAN AUTOMATED TRAFFIC CONTROL. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1964 - May 1978
Edith Kenton Jun. 1978 176 p Supersedes NTIS/PS-77/0512; NTIS/PS-76/0382; NTIS/PS-75/403; COM-73-11716
(NTIS/PS-78/0542/7; NTIS/PS-77/0512; NTIS/PS-76/0382; NTIS/PS-75/403; COM-73-11716) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

The control of urban vehicular traffic movement by means of automatic synchronization of intersection and lane signals is covered. Studies on sensing and telemetry devices, computer programming, models, system development, and route guidance systems are included. (This updated bibliography contains 170 abstracts, 22 of which are new entries to the previous edition.) GRA

N78-31004# Gruen Associates, Inc., San Francisco, Calif.
INDIRECT ENVIRONMENTAL IMPACTS
Jul. 1977 135 p Sponsored in part by HUD and Metropolitan Transportation Commission
(Contract DOT-OS-30176)
(PB-280201/5; DOT-BIP-TM-24-4-77) Avail: NTIS HC A07/MF A01 CSCL 13B

Land development and land-use policy changes are documented which have occurred in BART station areas between 1965 and 1975. The environmental impacts associated with developmental and policy changes near 12 BART stations were assessed. In addition, changes in station area development quality in terms of public improvements made to some of these areas are evaluated. GRA

N78-31005# Environmental Protection Agency, Chicago, Ill.
ENVIRONMENTAL ASSESSMENT GUIDANCE MUNICIPAL SEWAGE TREATMENT WORKS PROGRAM
Oct. 1977 91 p
(PB-280150/4; EPA-905/2-77-004) Avail: NTIS HC A05/MF A01 CSCL 13B

Environmental assessment guidance is given in the report to be used by consultants preparing facilities plans for municipal sewage treatment facilities. The purpose is to provide guidance for integrating environmental, social, and economic evaluations into the facility planning process. GRA

N78-31006# Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical-Engineering.
LAND MANAGEMENT OF SUBSURFACE-INJECTED WASTEWATER LIQUID RESIDUALS Interim Report
J. L. Smith, M. H. Lutkin, J. S. Latham, and A. DeHaai Nov. 1977 44 p refs Prepared in cooperation with Black and Veatch Consulting Engineers, Kansas City, Mo.
(Grant NSF AEN-74-08082)
(PB-280162/9; NSF/RA-770470) Avail: NTIS HC A03/MF A01 CSCL 13B

The objectives of this proof-of-concept experiment (POCE) are: To determine the acceptability of irradiation disinfection and subsurface injection as an alternative technology for current methods of stabilization and handling wastewater residuals, and to define specific operational characteristics and economics of irradiation disinfection and subsurface injection as a technology for treatment of wastewater residuals. The proposed POCE facility is adjacent to the sewage treatment plant at Lawrence, Kansas. This report establishes recommendations for construction and operation of the facility. GRA

N78-31007# Rohr Industries, Inc., Chula Vista, Calif.
TEST AND DEMONSTRATION PROTOTYPE TRACKED AIR CUSHION VEHICLE (PTACV): PHASE IIIC Final Report, Jan. 1976 - Nov. 1977
A. K. Smith, J. Dallas, R. Stott Dynes, and L. Samusson Nov. 1977 330 p refs
(Contract DOT-FR-54089)
(PB-279970/8; FRA/ORD-78/03) Avail: NTIS HC A15/MF A01 CSCL 13F

A six year multi-phased program for design, development and test of a prototype tracked air cushion vehicle was culminated in a six month test and demonstration. Descriptions of the various major sub-systems are presented with design and operational performance data. Technical data covering test objectives, descriptions and results are furnished on a wide variety of functional assemblies, subsystems and performance conditions. Physical characteristics were measured for accelerations, braking, aerodynamic drag, ride comfort, acoustical quality, reliability and maintainability performance. GRA

N78-31008# Wisconsin Univ., Madison. Dept. of Agricultural Economics.
EFFICIENT AND EQUITABLE PRICING FOR WASTEWATER SYSTEMS: THE MADISON METROPOLITAN SEWAGE DISTRICT Final Report
David H. Peterson and Daniel W. Bromley 1977 165 p refs
(Contract DI-14-31-0001-4139)
(PB-280170/2; WIS-WRC-77-09; W78-06358; OWRT-B-087-WIS(3)) Avail: NTIS HC A08/MF A01 CSCL 13B

Pricing policies for local public wastewater systems were investigated. The objectives of a pricing policy are the attainment of efficiency and equity. The existing pricing rules for both water and sewage services are the result of traditional utility rate practices. The primary emphasis on rate design has been to structure rates which will recover all the costs of service. The pricing model developed in this study shows how wastewater managers can choose a pricing rule for sewage services which can be considered to be both efficient and equitable. GRA

N78-31009# Urban Wildlife Research Center, Inc., Ellicott City, Md.
PLANNING FOR WILDLIFE IN CITIES AND SUBURBS
Daniel L. Leedy, Robert M. Maestro, and Thomas M. Franklin Jan. 1978 77 p Sponsored in part by Amer. Soc. of Planning Officials, Chicago, Ill.
(Contract DI-14-16-0008-2040)
(PB-280172/8; FWS/OBS-77/66) Avail: NTIS HC A05/MF A01 CSCL 13B

Opportunities for wildlife enhancement are discussed in relation to site design, urban core areas, suburbs and new towns. The importance of habitat diversity is stressed. Sources of additional information and assistance, lists of plants valuable to

wildlife, and recommended reading materials are provided in appendices. GRA

N78-31010# Purdue Univ., Lafayette, Ind. Water Resources Research Center.
DEVELOPMENT AND IMPLEMENTATION OF A REGIONAL WATER PLANNING DATA MANAGEMENT SYSTEM Completion Report, Jul. 1975 - Dec. 1977
A. B. Whinston Jan. 1978 202 p refs
(Contract DI-14-31-0001-6076; OWRT Proj. B-080-IND)
(PB-280174/4; TR-97; W78-06360; OWRT-B-080-IND(9))
Avail: NTIS HC A10/MF A01 CSCL 13B

An extension to the generalized planning (GPLAN) system approach integrates techniques from the field of data base management with artificial intelligence techniques and concepts, culminating in an intelligent decision support system. The report commences with a survey of the emergency discipline of decision support sytems. An example of a water quality management application is given within the GPLAN framework. Several extensions and corrections for the CODASYL approach to data management are given. There is an investigation of problems encountered in the management of water quality data that is logically distributed. A generalized mapping language is proposed as a mechanism for information transferral within a distrubuted data base, and a general data structure for supporting the mapping function is illustrated. GRA

N78-31011# District of Columbia Dept. of Environmental Services, Washington, D.C. EPA-DC Pilot Plant.
WASTEWATER TREATMENT FOR REUSE AND ITS CONTRIBUTION TO WATER SUPPLIES Final Report, Apr. 1975 - Sep. 1976
Howard P. Warner and John N. English Mar. 1978 51 p refs
(Contract EPA-68-03-0344)
(PB-280145/4; EPA-600/2-78-027) Avail: NTIS
HC A04/MF A01 CSCL 13B

Cost effective municipal wastewater treatment technology coupled with a computerized data handling system, was used to obtain data on the safety of the effluent for discharge upstream of drinking water intakes, and for potential domestic reuse purposes. Treatment reliability was demonstrated and performance results showed the absence of virus in the effluent. Effluent concentrations of radioactivity, trihalomethanes and other volatile organics, heavy metals, pesticides, TOC, turbidity, general inorganic compounds and pathogenic indicator organisms were shown to be similar to those found in finished drinking waters during the EPA National Organics Reconnaissance Survey in 1975. The specific organic compounds identified in the effluent are also present in finished drinking waters. GRA

N78-31012# SCS Engineers, Long Beach, Calif.
DATA BASE FOR STANDARDS/REGULATIONS DEVELOPMENT FOR LAND DISPOSAL OF FLUE GAS CLEANING SLUDGES Final Report
Dallas E. Weaver, Curtis J. Schmidt, and John P. Woodyard Dec. 1977 299 p refs
(PB-280135/5; EPA-600/7-77-118) Avail: NTIS
HC A13/MF A01 CSCL 13B

Flue gas cleaning (FGC) sludge disposal on land is considered from a potential regulatory approach. Factors that were taken into consideration include: (1) the origin of the FGC sludge problem (character of the fuel, combustion process, gas cleaning and sludge management); (2) criteria for the evaluation of sludge disposal options (sludge characteristics, health, ecological, safety, and aesthetic considerations); (3) applicable, existing or proposed standards/regulations (solid waste hazardous waste, drinking water, and air pollution regulations); and (4) impacts of applying existing standards/regulations to the disposal of flue gas cleaning sludges (cost aspects). GRA

N78-31013# SCS Engineers, Long Beach, Calif.
CONTAMINANTS ASSOCIATED WITH DIRECT AND INDIRECT REUSE OF MUNICIPAL WASTEWATER Final Report, 1 Jul. 1976 - 1 Dec. 1977
Mar. 1978 359 p refs
(Contract EPA-68-02-2257)
(PB-280482/1; EPA-600/1-78-019) Avail: NTIS
HC A16/MF A01 CSCL 13B

Published quantitative data are compiled that are available concerning the health effects associated with direct and indirect reuse of treated municipal wastewater for potable purposes. The assembled information includes data on the effectiveness of conventional water and wastewater treatment and disposal operations in reducing public health contaminant concentrations, as well as data on the transport of these contaminants through the environment back to man. Wastewater treatment processes evaluated include conventional secondary treatment and tertiary processes. Wastewater disposal techniques evaluated include direct discharge to fresh surface waters and land application. GRA

N78-31014# National Center for Resource Recovery, Washington, D. C.
CONTAMINANTS OF MAGNETIC METALS RECOVERED FROM MUNICIPAL SOLID WASTE: TIN, ALUMINUM, ORGANIC MATERIALS
E. Joseph Duckett Nov. 1977 61 p refs
(Grant NSF APR-75-13864)
(PB-279461/8; NSF/RA-770244) Avail: NTIS
HC A04/MF A01 CSCL 13B

Identified are technological barriers to increased recycling, where they exist, and approaches to overcoming any such barriers. Discussed are recovered magnetic metals - primarily steel cans recovered from municipal solid waste. A paper on tin as a contaminant of recovered steel is presented in abstract form. The other two papers, on aluminum and organic contaminants of recovered steel, are presented in final and complete form. GRA

N78-31015# North Carolina Univ. at Chapel Hill. Center for Urban and Regional Studies.
CONSTITUTIONAL ISSUES OF GROWTH MANAGEMENT
David R. Godschalk, David J. Brower, Larry D. McBennett, and Barbara A. Vestal 1977 305 p refs
(Grant NSF ENV-75-10672)
(PB-279915/3; NSF/RA-770410) Avail: NTIS
HC A14/MF A01 CSCL 13B

The fields of law and planning are directed toward local growth management that is both socially responsible and constitutionally defensible. The report includes: (1) an introduction identifying issues and participants in local growth management; (2) constitutional challenges that might be made to aid growth management efforts; (3) four sets of growth problems faced by many localities in the U.S. today; and (4) findings and conclusions about present and future directions in local growth management. GRA

N78-30401# Billings Energy Research Corp., Provo, Utah.
A HYDROGEN-POWERED MASS TRANSIT SYSTEM
R. L. Wooley *In* NATO Proc. of the 4th Intern. Symp. on Automotive Propulsion Systems, Vol. 2 Feb. 1978 p 768-773
(For primary document see N78-30370 21-31)
Avail: NTIS HC A22/MF A01

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N78-31016*# TAI Corp., Huntsville, Ala.
THREE-MIRROR SPACE TELESCOPE, VOLUME 2 Final Report
Dietrich Korsch Jul. 1978 23 p refs

(Contract NAS8-32829)
(NASA-CR-150774) Avail: NTIS HC A02/MF A01 CSCL 03A

The anastigmatic three mirror telescope for STARSAT, a space astronomy facility, was redesigned and reoptimized in order to improve the optical system and increase its versatility. A more compact system was obtained by decreasing the primary focal ratio from 2.2 to 2.0. A high performance Rowland spectrograph that uses only a total of three reflections and does not interfere with the imaging process, was successfully incorporated into the telescope so that it could be a permanent part of the system. The usefulness of this telescope concept as a high resolution coronagraph is examined. A.R.H.

N78-31017*# California Univ., Berkeley. Dept. of Physics.
THE POTENTIAL FOR ASTROMETRY IN THE INFRARED
John W. V. Storey 1978 11 p refs
(Grants NGL-05-003-272; NSF AST-77-12256)
(NASA-CR-157400) Avail: NTIS HC A02/MF A01 CSCL 03A

Infrared interferometry promises to be a useful astrometric technique. Preliminary measurements of the star alpha Orionis made with a heterodyne interferometer exhibit phase coherence over a period of at least 1000 seconds. The measurements were equivalent to a positional determination of 60 milliarcsecond accuracy every 5 seconds of integration. A.R.H.

N78-31018*# California Univ., Los Angeles. Dept. of Astronomy.
AN INVESTIGATION OF THE FAR ULTRAVIOLET SPECTRA OF THE POLE-ON Be STARS MU CEN AND UPSILON CYG Final Technical Report
Geraldine J. Peters 30 Sep. 1977 97 p refs
(Grant NsG-5056)
(NASA-CR-157399) Avail: NTIS HC A05/MF A01 CSCL 03A

The technique of spectrum analysis was used to interpret Copernicus U2 spectra (0.2 A resolution) and Lick Observatory coude spectra of the pole-on stars upsilon Cyg and Mu Cen. Features analyzed include C 11 lambda lambda 1176 and 1247 A, N 11 lambda lambda 1085 and 3995 A, Si IV lambda lambda 1265 and 1309 A, Si lambda lambda 1110, 1297, and 4568 A, and Si IV lambda 1128 A. An initial set of physical parameters is obtained from ground-based spectra for the selected UV features. In general, there is no difficulty in fitting the observed features with profiles computed from the same model atmosphere, abundances, and vsin i which are suggested by the visual spectral features. The analysis suggests an effective temperature of 24,000 K and a log g of 3.8 for upsilon Cyg. T sub eff and log g adopted for mu Cen are 20,500 K and 3.7, respectively. Upsilon Cyg appears to have a low abundance of carbon, but normal abundance of nitrogen and silicon. The abundances of nitrogen and silicon in mu Cen are normal; carbon results are inconclusive. A.R.H.

N78-31019*# Southern Univ., Baton Rouge, La. Dept. of Physics.
MANY-PARTICLE THEORY OF NUCLEAR SYSTEM WITH APPLICATION TO NEUTRON-STAR MATTER AND OTHER SYSTEMS Semiannual Status Report, Feb. 1978 - Jul. 1978
Chia-Hsiung Yang 25 Aug. 1978 7 p refs
(Grant NGR-19-005-006)
Avail: NTIS HC A02/MF A01 CSCL 30A

General problems in nuclear-many-body theory were considered. Superfluid states of neutron star matter and other strongly interacting many-fermion systems were analyzed by using the soft-core potential of Reid. The pion condensation in neutron star matter was also treated. G.G.

N78-31020*# TAI Corp., Huntsville, Ala.
ANALYSIS AND DESIGN OPTIMIZATION OF THE 1.2m X-RAY TELESCOPE, VOLUME 1 Final Report
Dietrich Korsch Jun. 1978 42 p
(Contract NAS8-32829)
(NASA-CR-150775) Avail: NTIS HC A03/MF A01 CSCL 03A

An image space analysis and optimization and a performance analysis of the telescope assembly in the presence of various alignment errors are reported. Possible tests arrangements for 1.2 m or 1.5 m diameter X-ray telescopes are elaborated. G.G.

N78-31021*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
X-RAY OBSERVATIONS OF A FLARE IN NGC4151 FROM OSO-8
Richard F. Mushotzky, S. S. Holdt, and P. J. Serlemitsos Jun. 1978 17 p refs Submitted for publication
(NASA-TM-79551) Avail: NTIS HC A02/MF A01 CSCL 03A

The 2-60 keV flux from NGC4151 changed by a factor of two on a timescale of 1.5 days. No fluctuations were detected in excess of a factor of three on timescales less than four hours. During a total observation of approximately 11 days there were no statistically significant changes in spectral shape. The spectrum was fitted by a power law with photon index alpha approximately 1.42 + or - 0.06 and column density N sub H approximately 7.5 + or - 0.5 x 10 to the 22d power at/cu cm. A 2 sigma residual to this fit implies fluorescent Fe line emission with E. W. approximately 240 eV. Both synchrotron self-Compton and thermal Compton models are consistent with the X-ray data. G.G.

N78-31022*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SURVEY OF CARBON MONOXIDE IN CYGNUS X Ph.D. Thesis - Columbia Univ.
Hong-ih Louis Cong Jul. 1978 169 p refs
(Contract NAS5-24452)
(NASA-TM-79590) Avail: NTIS HC A08/MF A01 CSCL 03A

Three major molecular cloud complexes in Cygnus X, each of which is associated with a group of H II regions and compact sources of OH, H2O masers are identified. Distances to the molecular clouds, as inferred from the optical objects, range from 200 to 2700 pc, with the above three cloud complexes at distances between approximately 1000 and 2000 pc. Molecular clouds associated with W75N seem to constitute part of the Great Rift, and are unrelated to the DR21 cloud complex. (C-13)(O-16) - (at 110.201 GHz) was also observed at approximately twenty molecular sources, and extensively mapped in the direction of W75. Ratios of (C-12)(O-16) to (C-13)(O-16) temperatures are generally a factor of 2 to 3, and the excitation temperatures in molecular sources range from 6 to 29 K. Total mass of all the molecular sources in Cygnus X is estimated at one million earth mass. A.R.H.

N78-31023*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANALYSIS OF STAR PAIR LATITUDES
Michael A. Graber Jul. 1978 13 p refs
(NASA-TM-79593) Avail: NTIS HC A02/MF A01 CSCL 03A

Star pair latitude observations forming the basis for the pole positions reported by the International Polar Motion Service (IPMS) are processed to produce a mean pole position. However, the time series of raw observations contains high frequency information which is lost in the calculation of the mean pole. Analysis of 2931 star pair observations reveals a possible large excitation at one cycle per solar day. The average power level in the frequency band of the tesseral tides is seen to be high, although the peaks do not occur at the expected tidal frequencies. A.R.H.

N78-31024# Geneva Observatory (Switzerland).
CATALOG OF PHOTOMETRIC STAR BOXES IN THE UBV B1B2V1G SYSTEM
M. Golay and N. Mandwewala 1977 108 p refs
(Publ-Ser-B-Fasc-3) Avail: NTIS HC A06/MF A01

The stellar contents of all the 0.01 mag photometric star boxes made using 7082 stars measured in the UBV B1B2V1G system are presented in tabular form. ESA

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

No abstracts in this category.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N78-31025 Pennsylvania State Univ., University Park.
THE KINETICS OF THE PSEUDOBROOKITE DECOMPOSITION REACTION AND ITS APPLICATION TO PROBLEMS IN LUNAR PETROLOGY Ph.D. Thesis
Douglas Allan Weirauch, Jr. 1978 113 p
Avail: Univ. Microfilms Order No. 78-12087

The rate at which pseudobrookite-structured phases decompose to a two-phase mixture of either ilmenite and rutile or spinel and rutile was investigated. The following compositions of pseudobrookite were examined. A quantitative X-ray diffraction technique was used to determine the amount of pseudobrookite remaining after reaction at various temperatures and periods of time. It was determined that the breakdown of the pseudobrookite structure proceeds by a mechanism of nucleation and diffusion-controlled growth. The nucleation is a mixture of random volume nucleation and surface (or grain boundary) nucleation. There is a crystallographic influence exerted by the host pseudobrookite structure upon the orientation of its decomposition products: rutile and ilmenite. Dissert. Abstr.

N78-31026*# Martin Marietta Corp., Denver, Colo.
STUDY OF ADVANCED ATMOSPHERIC ENTRY SYSTEMS FOR MARS Final Report
Jul. 1978 94 p refs Prepared for JPL
(Contract JPL-955075)
(NASA-CR-157548; MCR-78-582) Avail: NTIS HC A05/MF A01 CSCL 03B

Entry system designs are described for various advanced Mars missions including sample return, hard lander, and Mars airplane. The Mars exploration systems for sample return and the hard lander require decleration from direct approach entry velocities of about 6 km/s to terminal velocities consistent with surface landing requirements. The Mars airplane entry system is decelerated from orbit at 4.6 km/s to deployment near the surface. Mass performance characteristics of major elements of the Mass performance characteristics are estimated for the major elements of the required entry systems using Viking technology or logical extensions of technology in order to provide a common basis of comparison for the three entry modes mission mode approaches. The entry systems, although not optimized, are based on Viking designs and reflect current hardware performance capability and realistic mass relationships. A.R.H.

N78-31027*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN EMISSION MECHANISM FOR THE IO-INDEPENDENT JOVIAN DECAMETER RADIATION
Melvyn L. Goldstein and Aharon Eviatar (Tel-Aviv Univ.) Jul. 1978 46 p refs Submitted for publication
(NASA-TM-79586) Avail: NTIS HC A03/MF A01 CSCL 03B

A theory of the Io-independent decameter radiation is developed. The radiation results from excitation of the electromagnetic loss-cone instability by keV electrons, stably trapped near L = 6. The radiation is excited in Band 3 of the extraordinary mode. When the effects of refraction are estimated, it is shown that above 10 MHz radiation is beamed into the equatorial plane in a wide, but thin, conical sheet (Psi approximately equals 80 degrees). When the instability analysis is coupled with one of the octupole models of the Jovian magnetic field, the maximum convective growth of the instability occurs in the directions of the non-Io A, B, and C sources. The shape of the peak radio flux frequency spectrum is found to be a consequence of the loss cone shape of the electron distribution function. Author

N78-31028*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DISCREPANCY IN PROTON FLUX EXTRAPOLATION ALONG FIELD LINES IN THE MIDDLE JOVIAN MAGNETOSPHERE
A. W. Schardt and T. J. Birmingham Aug. 1978 39 p refs
(NASA-TM-79624) Avail: NTIS HC A03/MF A01 CSCL 03B

Fluxes of energetic electrons and protons in Jupiter's outer magnetosphere were observed to be modulated with the 10 hour rotation period of the planet. This modulation was due to the concentration of particles at the magnetic equator: the non-alignment of Jupiter's spin and rotation axes caused Pioneer-10 to oscillate between +20 deg and -19 deg magnetic latitude and hence, between regions of stronger and weaker fluxes. The relationship between electron and proton fluxes observed off the magnetic equator was countered with measurements at the equatorial crossing radii of the same flux tubes by applying Liouville's theorem with the assumption that particles move conserving their magnetic moments. A magnetic model which matches the intensity and direction of the magnetic field along the Pioneer 10 trajectory was used for determining the positions of the equatorial crossings. Energetic electrons compared in this way appear to be consistently described. Protons, on the other hand, show much weaker fluxes at the off-equatorial points than would be predicted by this simple application of Liouville's theorem. G.G.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N78-31029*+ Hawaii Univ. at Manoa, Honolulu. Inst. for Astronomy.
HIGH RESOLUTION ATLAS OF THE SOLAR SPECTRUM 2678-2931 A
Marc S. Allen, Howard C. McAllister, and John T. Jefferies [1977] 114 p refs Atlas data also on magnetic tape. Avail: Inst. for Astronomy, 2680 Woodlawn Drive, Honolulu, Hawaii 96822 Attn: Marc Allen
(Grant NGL-12-001-075)
(NASA-CR-157396) Avail: NTIS HC A06 CSCL 03B

A portion of the ultraviolet solar spectrum is presented in this high resolution atlas. The data, originating from a rocket echelle spectrogram obtained on 19 June 1974 of a quiet area near the center of the solar disk, extend from 2678 to 2931 A. The instrument had a nominal resolving power of 200,000 at these wavelengths and the rms precision of the rectified wavelength scale is 15 mA. Absolute intensities are computed by calibration to the absolute measurements of Kohl and Parkinson. A.R.H.

N78-31030*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PIONEER 10 OBSERVATION OF THE SOLAR WIND PROTON TEMPERATURE HELIOCENTRIC GRADIENT
J. D. Mihalov and J. H. Wolfe Aug. 1978 15 p refs
(NASA-TM-78515; A-7579) Avail: NTIS HC A02/MF A01 CSCL 03B

Solar wind isotropic proton temperatures as measured out to 12.2 AU heliocentric distance by the Ames plasma analyzer aboard Pioneer 10 are presented as consecutive averages over three Carrington solar rotations and discussed. The weighted least-squares fit of average temperature to heliocentric radial distance, R, yields the power law R sup -.52. These average proton temperatures are not correlated as well with Pioneer 10's heliocentric radial distance (-.85) as are the corresponding average Zurich sunspot numbers R sub z (-.95). Consequently,

it is difficult to isolate the spatial gradient in the Pioneer 10 solar wind proton temperatures using that data alone. Author

N78-31031*# Stanford Univ., Calif. Inst. for Plasma Research.
REVERSE CURRENT IN SOLAR FLARES
Joshua W. Knight, III Aug. 1978 139 p refs
(Grant NGL-05-020-272; Contract N00014-75-C-0673)
(NASA-TM-79749; SU-IPR-752) Avail: NTIS HC A07/MF A01 CSCL 03B

An idealized steady state model of a stream of energetic electrons neutralized by a reverse current in the pre-flare solar plasma was developed. These calculations indicate that, in some cases, a significant fraction of the beam energy may be dissipated by the reverse current. Joule heating by the reverse current is a more effective mechanism for heating the plasma than collisional losses from the energetic electrons because the Ohmic losses are caused by thermal electrons in the reverse current which have much shorter mean free paths than the energetic electrons. The heating due to reverse currents is calculated for two injected energetic electron fluxes. For the smaller injected flux, the temperature of the coronal plasma is raised by about a factor of two. The larger flux causes the reverse current drift velocity to exceed the critical velocity for the onset of ion cyclotron turbulence, producing anomalous resistivity and an order of magnitude increase in the temperature. The heating is so rapid that the lack of ionization equilibrium may produce a soft X-ray and EUV pulse from the corona. A.R.H.

N78-31032*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TIME DELAY OCCULTATION DATA OF THE HELIOS SPACECRAFT FOR PROBING THE ELECTRON DENSITY DISTRIBUTION IN THE SOLAR CORONA Final Report
Peter Edenhofer (DFVLR), Ernst Lueneburg (DFVLR), Pasquale B. Esposito, Warren L. Martin, Arthur I. Zygielbaum, Richard T. Hansen (High Altitude Obs., Boulder, Colo.), and Shirley F. Hansen (High Altitude Obs., Boulder, Colo.) Aug. 1978 48 p refs Sponsored by NASA and Bundesministerium fuer Forsch. und Technol.
(NASA-CR-156950; BMFT-FB-W-78-03) Avail: NTIS HC A03/MF A01

S-band time delay measurements were collected from the spacecraft Helios A and B during three solar occultations in 1975/76 within heliocentric distances of about 3 and 215 earth radius in terms of range, Doppler frequency shift, and electron content. Characteristic features of measurement and data processing are described. Typical data sets are discussed to probe the electron density distribution near the sun (west and east limb as well) including the outer and extended corona. Steady-state and dynamical aspects of the solar corona are presented and compared with earth-bound-K-coronagraph measurements. Using a weighted least squares estimation, parameters of an average coronal electron density profile are derived in a preliminary analysis to yield electron densities at r = 3, 65, 215 earth radius. Transient phenomena are discussed and a velocity of propagation v is nearly equal to 900 km/s is determined for plasma ejecta from a solar flare observed during an extraordinary set of Helios B electron content measurements. A.R.H.

N78-31033*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A THEORY OF LOCAL AND GLOBAL PROCESSES WHICH AFFECT SOLAR WIND ELECTRONS. 1: THE ORIGIN OF TYPICAL 1 AU VELOCITY DISTRIBUTION FUNCTIONS: STEADY STATE THEORY
Jack D. Scudder Aug. 1978 55 p refs
(NASA-TM-79621) Avail: NTIS HC A04/MF A01 CSCL 03B

A detailed first principle kinetic theory for electrons which is neither a classical fluid treatment nor an exospheric calculation is presented. This theory illustrates the global and local properties of the solar wind expansion that shape the observed features of the electron distribution function, such as its bifurcation, its skewness and the differential temperatures of the thermal and suprathermal subpopulations. Coulomb collisions are substantial mediators of the interplanetary electron velocity distribution function and they place a zone for a bifurcation of the electron distribution function deep in the corona. The local cause and effect precept which permeates the physics of denser media is modified for electrons in the solar wind. The local form of transport laws and equations of state which apply to collision dominated plasmas are replaced with global relations that explicitly depend on the relative position of the observer to the boundaries of the system. S.B.S.

N78-31034# Los Alamos Scientific Lab., N. Mex.
SOLAR OPACITY AND EQUATION OF STATE
W. F. Huebner 1978 27 p refs Presented at Solar Neutrino Conf., Upton, N. Y., 5-7 Jan. 1978
(Contract W-7405-eng-36)
(LA-UR-78-196; Conf-780117-1) Avail: NTIS HC A03/MF A01

The disadvantages of radiative diffusion over radiative transfer in the photosphere as used in structure calculations are reemphasized. Uncertainties in the opacity due to uncertainties in chemical composition and in approximations of the physics are described and estimated. Internal consistency of equation of state and opacity is recommended. ERA

N78-31035# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 403, MARCH 1978. PART 1, PROMPT REPORTS: DATA FOR FEBRUARY 1978 - JANUARY 1978
Helen E. Coffey Mar. 1978 151 p 2 Vol.
(PB-281811/0; SGD-403-Pt-1; NOAA-78041804) Avail: NTIS HC A08/MF A01 CSCL 03B

Data are provided for February 1978 on: alert period, daily solar indices, solar flares, solar radio waves, solar X-ray radiation, coronal holes, solar wind measurements, inferred IP magnetic field polarities, and mean solar magnetic field. Also included was data for January 1978 on: daily solar activity center, sudden ionospheric disturbances, solar X-ray radiation, solar radio waves, cosmic rays, geomagnetic indices, and radio propagation indices. GRA

N78-31036# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 403, MARCH 1978. PART 2, COMPREHENSIVE REPORTS: DATA FOR SEPTEMBER 1977 - AUGUST 1977 AND MISCELLANEA
Helen E. Coffey Mar. 1978 70 p 2 Vol.
(PB-281812/8; SGD-403-Pt-2; NOAA-78041805) Avail: NTIS HC A04/MF A01 CSCL 03B

This comprehensive report for September 1977, August 1977 and miscellaneous data provides data on: active regions, synoptic solar maps, solar flares, solar radio waves, energetic solar particles and plasma, synoptic chart, abbreviated calendar record, regional flare index, solar radio waves, and geomagnetic indices. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N78-31037 Washington Univ., Seattle.
A STUDY OF COSMIC RAY MUONS AND THEIR ASSOCIATED SHOWER PARTICLES UNDERWATER Ph.D. Thesis
Steven Nels Anderson 1978 97 p
Avail: Univ. Microfilms Order No. 78-14400

The nucleonic contamination of the underwater cosmic ray muon flux is studied as a function of depth. Stacks of Ilford G-5 photographic emulsions were assembled and processed in an underground laboratory (9 hg/cu cm below sea level). In between the assembly and the development they were exposed, stored in small pressure chambers, at various depths underwater for periods of time up to six months. At each depth approximately 1010 cu cm of emulsion were scanned for stopping particles and nuclear disintegrations. Altogether approximately 2000 stopping muons, 50 stopping mesons, and 200 recoil protons were found and analyzed. Comparison with theories as to how the underground cosmic ray muon beam produces a

secondary flux of nuclearly active particles are made. Additionally, measurements on the residue flux at 4400 mwe underground are made. Dissert. Abstr.

N78-31038*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DISCOVERY OF IRON LINE EMISSION IN THE HERCULES X-1 LOW STATE SPECTRUM WITH HEAO-1
S. H. Pravdo, E. A. Boldt, S. S. Holt, R. E. Rothschild, and P. J. Serlemitsos Jul. 1978 17 p refs Submitted for publication
(NASA-TM-79591) Avail: NTIS HC A02/MF A01 CSCL 03B

The line energy, equivalent width, binary phase dependence, and intrinsic width of the iron line emission feature observed in the low state sepctrum of Hercules X-1 are examined. Deductions are made concerning secondary X-ray emission from this binary system. A.R.H.

N78-31039*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETIC FIELDS, PLASMAS, AND CORONAL HOLES: THE INNER SOLAR SYSTEM
Leonard F. Burlaga Jul. 1978 32 p refs Submitted for publication
(NASA-TM-79598) Avail: NTIS HC A03/MF A01 CSCL 03B

In situ magnetic field and plasma observations within 1 AU which describe MDH stream flows and Alfvenic fluctuations, the latest theories of those phenomena are discussed. Understanding of streams and fluctuations was enhanced by the acquisition of nearly complete sets of high resolution plasma and magnetic data simultaneously at two or more points by IMPs 6, 7, and 8, Mariner-Venus-Mercury, HELIOS 1, and HELIOS 2. Observations demonstrate that streams can have very thin boundaries in latitude and longitude near the sun. This has necessitated a revision of earlier views of stream dynamics, for it is now clear that magnetic pressure is a major factor in the dynamics of stream in the inner solar system and that nonlinear phenomena are significant much closer to the sun than previously believed. Simultaneous IMP 6, 7, and 8 observations of Alfvenic fluctuations indicate that they are probably not simply transverse Alfven waves and suggest that Alfvenic fluctuations are better described as nonplanar, large-amplitude, general Alfven waves moving through an inhomogeneous and discontinuous medium, and coupled to a compressive mode. A.R.H.

N78-31040*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DIFFUSE FLUXES OF COSMIC HIGH ENERGY NEUTRINOS
F. W. Stecker Jul. 1978 30 p refs Submitted for publication
(NASA-TM-79609) Avail: NTIS HC A03/MF A01 CSCL 03B

Production spectra of high-energy neutrinos from galactic cosmic ray interactions with interstellar gas and extragalactic ultrahigh energy cosmic-ray interactions with microwave black-body photons are presented and discussed. These production processes involve the decay of charged pions and are thus related to the production of cosmic gamma-rays from the decay of neutral pions. Estimates of the neutrino fluxes from various diffuse cosmic sources are then made and the reasons fro significant differences with previous estimates are discussed. Predicted event rates for a DUMAND type detection system are significantly lower than early estimates indicated. Author

99 GENERAL

No abstracts in this category.

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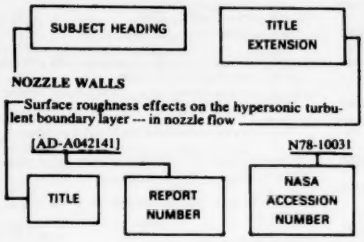

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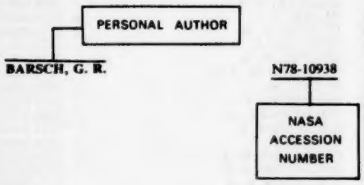

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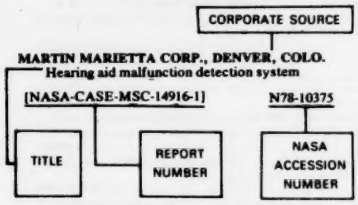

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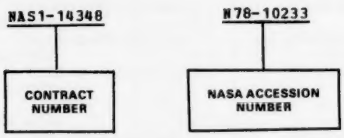

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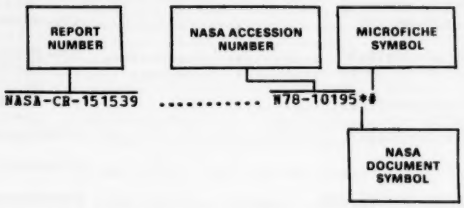

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